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In the Soup: Caustic Ingestion from the Improper Consumption of a Self-Heating Soup

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INTRODUCTION
There are an estimated 5,000-15,000 caustic injuries resulting from ingestion per year in the United States, with bimodal peaks of incidence at <5 and between 20-30 years of age.\(^1,2\) Most of these ingestions represent alkali exposures; however, in developing countries, acids are more readily available and result in more injuries.\(^1-3\) The source of caustic exposure is commonly from household chemicals.\(^3-7\)

We report a case of a caustic exposure presenting to the emergency department (ED) from the improper use of a food product. The ingested substance in our case was an alkali solution used to heat the product. OnTech\(^8\) Hillside made several self-heating food product canisters, such as coffee and soup containers. These food canisters were marketed as a means for commuters, sports enthusiasts, and other people with no readily available heating source to have hot soups and drinks.\(^3\) The top compartment of the can contains the food product and the bottom compartment has a calcium oxide heating element and a small bag of water. The underside of the bottom compartment has a peel-off metal lid concealing a button. Pushing down upon the button releases the water and activates the calcium oxide heating element, producing calcium hydroxide and heat. The 2 compartments remain separate, allowing the food compartment to be heated without mixing with the calcium hydroxide. The outside of the can has a small heat sensitive label that changes color when the product is at the proper temperature for consumption. After the ideal temperature is reached, the top of the container can be opened and the product can be consumed (Figure).

CASE PRESENTATION
The patient is a 54-year-old male who opened a can of OnTech\(^8\) Hillside tomato soup one morning after consuming a large, but unquantified amount of alcoholic beverages. The patient says he opened the top food-containing compartment of the canister and poured the soup into a bowl. He subsequently cut open the bottom calcium oxide containing compartment of the canister with a pocket knife and combined...
the powdered heating element with the soup. Upon consuming
the mixture, he stated he began feeling an intense burning
sensation in the back of his throat. It was at that time he also
noted that the mixture was getting hard “like plaster.” He
immediately drank a can of beer in an attempt to soothe the
burning sensation.

About 45 minutes after the ingestion he reported to
the ED complaining of pain with swallowing that radiated
into his chest. He denied drooling, hoarseness, dyspnea,
abdominal pain, nausea, vomiting, diarrhea, or bloody stools.
He also denied any recent illness or history of odynophagia
or chest pain. He had medical history significant for
hypertension, chronic obstructive pulmonary disease,
gastroesophageal reflux disease (GERD), and anxiety. His
medications included olanzapine, lisinopril, lorazepam,
omeprazole, verapamil, fluoxetine, and zolpidem. He stated
that he consumes an unquantified amount of alcohol daily,
smokes occasional marijuana, and is a former tobacco
smoker. His review of systems was negative except for the
presenting complaints.

On physical exam the patient appeared uncomfortable,
but was in no acute respiratory distress. His breath smelled
of alcohol, but he was alert, oriented, and appeared clinically
sober. He was acting and conversing appropriately with good
insight. His presenting vital signs were a blood pressure of
152/74 mm Hg, a pulse of 92 beats per minute, respirations of
18 breaths per minute, an oral temperature of 98.2°F, and
a room air pulse oximetry reading of 95%. He showed no
external signs of trauma and was not drooling. He was noted
to have mild erythema in the posterior oropharynx, with no
edema, blistering or exudate. He was able to swallow water,
but experienced severe pain doing so. His neck was supple
with no jugular venous distention, his lungs were clear to
auscultation, and his cardiac exam revealed normal heart tones
without murmurs. His abdominal examination revealed normal bowel sounds, soft, nontender, no rebound or guarding, no
organomegaly, and his stool was negative for gross or occult
blood. On neurological examination he was alert and oriented
to person, place and time with no focal deficits.

After the initial history and physical exam, an intravenous
(IV) line was placed and his pain was treated with intravenous
fentanyl. A search of the product website revealed that the
chemical powder contained calcium oxide, which forms
calcium hydroxide and heat when mixed with water. This
added concern for an alkali burn along with thermal burn. The
Statewide Poison Control Center was contacted as it was not
immediately clear what comprised the ingested powder. The
Statewide Poison Control Center was not familiar with the
product, but felt it may have contained an iron and charcoal
compound that could produce an exothermic reaction when
mixed with water. Their advice was to obtain a serum iron
product, but felt it may have contained an iron and charcoal

DISCUSSION

Generally, adult caustic ingestions are much more serious
due to the suicidal intent and the large volume consumed.1,3
Our presented case, as described, is an accidental ingestion
of a caustic substance and therefore is not what is typically
encountered with an adult caustic ingestion. The typical adult
ingestion is a purposeful ingestion with suicidal intent using
large consumed volumes.1,3 Children account for about 80% of
the accidental caustic ingestions and tend to be less severe due
to the smaller volume consumed.1,3

No other cases of caustic ingestion due to improper
consumption of self-heating soup were found on a search of
Medline, Ovid, or the internet. This case was unique as
it is the first documented human ingestion of a self-heating
element together with a food product, despite clear labeling
instructions for preparing the soup. The can states to flush
with “generous amounts of water” in case accidental contact
with heating material occurs, but makes no comment about
what to do in case of accidental ingestion.

The pH of a caustic substance should be considered
after any ingestion. A search of the product website did not
reveal a pH of the calcium oxide heating element solution.
However, according to a material safety data sheet (MSDS)
for calcium oxide, a 1% solution has a pH of 10.9 We were
unable to determine what the exact concentration the solution
was for this ingestion, but the pH was likely <12, although
a determination was never conducted. It was most likely a
small amount of the substance, and then diluted shortly after
ingestion due to the burning sensation our patient felt, which
reduced the concentration and contact time. Of interest,
this patient diluted the substance by drinking beer after the exposure. The beer consumption may have also had the benefit of removing any potential solid particles that may not have dissolved into solution from the mucosa.

Knowing the potential complications of caustic ingestions, emergency physicians should be aggressive in diagnostic staging if any adult or child presents with concerning history or findings. Hoarseness or stridor can indicate epiglottic or laryngeal involvement, and an evaluation and management of the upper airway should occur.1 Dysphasia, odynophagia, abdominal pain, substernal chest pain, vomiting, and drooling are other worrisome findings that should prompt imaging and possibly endoscopy.3,6,7 Endoscopy is generally considered safe immediately after caustic injury, but should be avoided 5-15 days after exposure due to mucosal sloughing and lack of collagen deposition during this time period.1 There is conflicting evidence regarding diagnostic staging in pediatric ingestion. Some studies state that an asymptomatic child with accidental ingestion and no objective signs of injury can safely be discharged from the ED without EGD, while other studies recommend laryngoscopy and esophagoscopy 48 hours after all pediatric ingestions.3,6,7 Unfortunately, the lack of symptoms has not been proven to preclude need for emergent endoscopy; therefore, clinical suspicion and the type and amount of the caustic ingestion must also be taken into account.3,6

In this case the pH, volume, concentration, and physical state of the ingested substance were not definitively known. Our patient continued to have worsening symptoms of odynophagia, and had objective erythema of posterior oropharynx. These signs and symptoms, coupled with a lack of established experience with the ingested substance, and the potential for long-term complications, determined our need for the emergent EGD.

There is also conflicting evidence and some controversy about the use of steroids and antibiotics after a caustic ingestion.1,3,5,6 Some anecdotal evidence indicates that sucralfate is beneficial in stricture prevention.5 Acid reflux may worsen a caustic injury, so acid suppression therapy in patients with GERD has been recommended.3 Physicians may want to consider usage in all patients, due to the possibility that acid reflux can result from the injury itself.3 We addressed acid suppression therapy in this case by encouraging compliance with his current PPI therapy, the addition of sucralfate and GI follow up.

CONCLUSION

We presented a case of an unusual caustic ingestion with a benign diagnostic EGD. Despite this patient having oropharyngeal erythema and prolonged odynophagia, only a minor injury was sustained from the ingestion. Given this presentation, future ingestions of this type and quantity are likely to be of low risk. However, this represents only one case report; clinical circumstances should still dictate management strategies.

REFERENCES