Circumferential esophageal burn injury from repeated oral ingestion of benzalkonium chloride (0.13%) foam hand sanitizer for children

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ABSTRACT

Benzalkonium chloride (BAC) is a common topical antiseptic. Ingestion of the compound may lead to injury of the esophagus. A six-year-old male was admitted after four days of vomiting with coffee ground emesis and abdominal pain after repeated ingestion of “Band-Aid Hurt-Free cleansing and infection protection foam™, containing 0.13% BAC. An upper endoscopy revealed marked circumferential esophagitis, requiring supportive care with total parenteral nutrition and eventual gastrostomy placement. The patient was treated with sucralfate, proton pump inhibitor therapy, and enteral nutritional support. One month after discharge the child was tolerating oral feedings and the gastrostomy tube was removed. BAC has been reported to cause injury through its caustic irritant and possible allergenic components. This is the first report of repeated ingestion of hand sanitizer containing 0.13% BAC causing significant esophageal injury and morbidity in a pediatric patient. Parents and health care providers should be aware of the potential risk of accidental ingestion of BAC-containing hand sanitizers.

INTRODUCTION

Benzalkonium chloride (BAC) is quaternary ammonium cationic detergent which is a common ingredient in several common household and hospital antiseptics, disinfectants, detergents and also as a preservative in medications such as ophthalmic and nasal solutions. There has been debate in regards to its classification as irritant versus allergen and even possible histological alteration.1 We report a case of repeated ingestion of hand sanitizer containing 0.13% BAC causing significant esophageal injury and morbidity in a pediatric patient.

CASE REPORT

A six-year-old male with history of autism, milk protein allergy and wheat sensitivity was admitted to Johns Hopkins All Children’s Hospital in St. Petersburg, Florida USA with symptoms of abdominal pain, poor oral intake and six episodes of coffee ground emesis over a four-day period. Upon admission, his medications included oral probiotics, vitamin B12, calcium and magnesium supplements, and he was eating a gluten and casein-free diet. There were no reported allergies.

The mother was suspicious for oral ingestion of “Johnson & Johnson Band-Aid Hurt-Free cleansing and infection protection foam™, which contains 0.13% BAC. She had observed him holding the pumping foam bottle in his mouth and sucking on the dispensing area of the pump intermittently for several days prior to admission.

Upon arrival to the hospital, the child was sleepy, but arousable with an unremarkable physical exam. His screening laboratory evaluation and urine drug test upon admission were unremarkable. The child was made NPO and was started on oral lansoprazole and sucralfate; however, due to his oral refusal, the patient was switched to intravenous ranitidine for gastric protective measures. An upper endoscopy the next day showed marked esophagitis with circumferential white exudates and petechiae covering the distal third of the esophagus along with linear involvement of the middle esophagus (Figure #1),

Key words: Benzalkonium chloride, hand sanitizer, ingestion, esophageal injury
consistent with a Grade 2b esophageal injury using Zargar's endoscopic grading classification1 (Table #1). Gastric erythema and mucosal friability was also identified along with coffee ground material. Duodenum was normal but oral cavity inspection revealed burn injury at the gum line (Figure #2) and oral cavity was normal appearing. Biopsies were obtained from the duodenum, stomach, and mid esophagus for analysis. The histological sections of the esophagus were consistent with pieces of fragmented squamous mucosa that display hyperplastic changes, associated with neutrophils within the basal layer of the epithelium. There was also tissue with degenerating cellular debris and inflammatory cells, consistent with acute and chronic inflammation with reparative changes, suggesting of chemical injury (Figure #3). The gastric mucosa and small bowel specimens demonstrated no acute inflammatory changes and fungal and viral cultures were negative.

![Figure 1: Initial endoscopy showing proximal, mid- and lower esophagus](image1)

![Figure 2: Oral cavity inspection revealing burn injury at the gum line](image2)

**Table 1: Zargar’s endoscopic classification of burns**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description</th>
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</thead>
<tbody>
<tr>
<td>Grade 0</td>
<td>Normal examination</td>
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<tr>
<td>Grade 1</td>
<td>Edema and hypermia of the mucosa</td>
</tr>
<tr>
<td>Grade 2a</td>
<td>Superficial ulceration, erosions, friability, blisters</td>
</tr>
<tr>
<td>Grade 2b</td>
<td>Grade 2a plus circumferential ulcerations</td>
</tr>
<tr>
<td>Grade 3a</td>
<td>Small scattered areas of multiple ulceration and areas of necrosis with brown-black or greyish discoloration</td>
</tr>
<tr>
<td>Grade 3b</td>
<td>Extensive necrosis</td>
</tr>
</tbody>
</table>

![Figure 3: Esophagus pathology slide: Fragmented squamous mucosa that display hyperplastic changes, associated with neutrophils within the basal layer of the epithelium. There was also tissue with degenerating cellular debris and inflammatory cells, consistent with acute and chronic inflammation with reparative changes, suggesting of chemical injury](image3)

![Figure 4: Endoscopy 2 years after initial presentation: distal esophagus](image4)
Given the circumferential nature of the esophageal injury, a nasogastric tube was placed for stricture prophylaxis and enteral nutritional support. However, the patient did not tolerate the nasogastric tube and underwent eventual surgical gastrostomy tube placement on hospital day #4. Follow-up endoscopy on hospital day #5 showed healing esophageal mucosa with patchy exudate involving approximately 2/3 of the distal esophageal circumference and resolution of the oral lesions. The patient was discharged home on hospital day #7 while tolerating an elemental formula diet, sucralfate and lansoprazole. Follow-up endoscopy two weeks after discharge showed significant improvement of circumferential esophageal burn with residual esophageal erosion seen at 26 cm from the bite block but no evidence of stricturing or narrowing.

One month after discharge the child was tolerating oral feeds and the gastrostomy tube was removed. Patient was lost to follow up but presented two years later with hematemesis and a repeat endoscopy showed remarkable esophagitis (Figure #4). Biopsy of the esophagus at that time revealed extensive necrosis of the muscularis mucosa (Figure #5), suggestive of repeated chemical injury.

**DISCUSSION**

The patient in this case repeatedly ingested a common antiseptic containing BAC, resulting in a grade 2B distal esophageal injury. The question regarding this caustic ingestion is whether this was a pure chemical esophagitis or whether an allergic component is involved. When seeking conformation from a histologic stand point, inflammatory and non-specific changes can be seen in both allergic and caustic tissue exposure. Basketter et al, classified BAC as an irritant, but doubt still remains as to whether or it is also a contact allergen. However, controlled studies mentioned in this discussion do support that BAC can act as an allergen in some instances.

Despite the commonality of BAC in consumer germicidal agents and easy accessibility, it is not a benign compound and in some cases can be lethal. The importance of exercising caution and care with all consumer products is strongly encouraged. In one case, a nursing home resident who ingested “Hosemin”, a 10% BAC aqueous solution, died after consumption of the chemical. Autopsy findings showed corrosive changes on mucosal surfaces of the tongue, pharynx, larynx, esophagus, and stomach. Furthermore, accidental ingestion of BAC by six infants resulted in hyperemia and fibrin plaques in the oropharynx as well as burns in the esophagus graded between grade 1 and 2A. A two day old infant whom was accidentally given two teaspoons of a 10% BAC solution required intubation secondary to laryngeal edema and developed pneumonia with a prolonged hospital stay of thirty-three days. In another case, a two day old neonate was purposely given a spoonful of 10% BAC with her mother believing it might help resolve infant’s cough. The infant developed grade two caustic esophageal injury, which improved by day ten of admission.

The potential for injury or even death of improper use of a consumer product is important for the public to be made aware that despite the existence of a children’s formulation, such as Johnson and Johnson’s hand sanitizer, there are possible consequences with the usage and potential ingestion of a seemingly benign consumer product. In recent news, attention has been called to contents in hand soaps. On September 2, 2016; the United States Food, Drug Administration (FDA) banned 19 specific ingredients, not including BAC, but the rule does not apply to waterless hand sanitizers or antibacterial soaps used in the healthcare setting. The FDA has given one year to show the safety and effectiveness of BAC, so antibacterial washes with this key ingredient may still be manufactured and in people’s homes.

There has been debate as to whether BAC is an allergen, and there are few case studies in which BAC is ingested leading to esophageal injury. In the study by Uter et al., BAC was skin tested following the international patch test standards at a concentration of 0.1% in patients suspected to be exposed to preservatives or disinfectants. This study demonstrated that with sufficient exposure, a contact sensitization can occur with BAC, which can lead to unequivocal allergic patch testing. However, it was concluded that the irritant BAC has sensitizing properties, but is a very rare contact allergen. A study published in the American Contact Dermatitis Society Journal concluded that the number of BAC allergic patch tests have increased in recent years when looking at patch testing at Mayo clinic from 2000 to 2012. The BAC reaction in our patient presented is more likely caustic rather than allergic based upon the histologic findings. Our patient did not undergo allergy testing.

BAC also possesses potential neurotoxic properties. In an experiment using rats, topical BAC was applied to the muscularis of the lower esophagus, resulting in distal narrowing...
and proximal dilation on esophagram and increased lower esophageal sphincter pressure on manometry, mimicking achalasia. Esophageal tissue exposed to topical BAC in this study noted an absence of ganglion cells in the intermyenteric and submucosal plexus. Improper use of BAC can result in potential caustic irritation, contact allergy, neurologic injury, and in some instances, even death. Repeated oral ingestion of hand sanitizer containing 0.13% BAC can cause significant morbidity in the pediatric population. Parents and health care providers should be aware of the potential risk of accidental BAC ingestion.

REFERENCES