

## A case of accidental benzalkonium chloride (10 %) ingestion

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### ABSTRACT

#### A case of accidental benzalkonium chloride (10 %) ingestion

Benzalkonium chloride (BAC) is a cationic surfactant which is widely used for antiseptis and disinfection in hospitals, at home and public places. Benzalkonium chloride solutions of 10 % or more are toxic to humans. We report the case of a member of medical staff who accidentally ingested BAC and emphasize the importance of immediate medical treatment which can both improve outcome and reduce complications. Treatment modalities vary from supportive treatment to surgery. In our case, the management consisted of gastric lavage, antibiotics, corticosteroids, total parenteral nutrition and proton-pump inhibitors. As BAC ingestion is rare and current literature does not give clear instructions of what to do in such a situation, we aimed to give a brief survey of treatment options in severe exposure to concentrated BAC solution, to assess the fundamental affects and to give guidelines for managing similar situations.

**Key Words:** Highly concentrated benzalkonium chloride solution (10 %), Ingestion, Poisoning

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### Introduction

Benzalkonium chloride (BAC) is a cationic surfactant which is widely used in the formulation of disinfectants and bactericidal sanitisers for healthcare in hospitals, at home and public places. Like other quaternary ammonium compounds, BAC is widely used as a germicide for the disinfection of medical utensils because the aqueous solution has low surface tension<sup>1</sup> and also in ophthalmic, nasal and aural pharmaceutical preparations. The safety factor of BAC allows its usage in household products and a wide range of leave-on skin sanitisers and baby wipes. Although BAC has been in clinical use since 1935 its toxicity is not well established.<sup>2</sup> The toxic effects depend on dose and the route of admission and poisoning can be fatal.<sup>3</sup> Depending on the purposes, different concentrations that vary from 1:750 to further dilutions of BAC solutions may be used. Solutions may be bacteriostatic or bactericidal according to

their levels of concentration. Aqueous solutions of BAC vary from neutral to slightly alkaline and are generally colourless, and non-staining. They have a bitter taste, aromatic odor, and foam when shaken. Concentrated BAC solutions (concentration of 10 % or more) are toxic to humans, as they can cause skin and mucosa irritation to the skin and mucosa, chemical burns and death if taken internally.<sup>4</sup> We report the case of a member of medical staff who accidentally ingested BAC and emphasize the importance of immediate medical treatment which can both improve outcome and reduce complications. As BAC ingestion is rare and current literature does not give clear instructions of what to do in such a situation, we aimed to give a brief survey of treatment in severe exposure to concentrated BAC solution, to assess the fundamental affects and to give guidelines for managing similar situations.

### Case report

A 28 year-old woman, a member of staff in a family medicine clinic accidentally swallowed half a glass (approximately 125 ml) of highly concentrated (10 %) BAC solution which was being used for sterilizing otoscope / ear speculums. The solution had not been further diluted with water yet. On

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the way to the hospital, the Poison Control Center was called. Her feelings of restlessness, apprehension and worry were appreciable half an hour later after exposure. After an hour, signs of gastrointestinal irritation such as nausea, vomiting appeared. Because of the soapy characteristic of BAC solution, her vomit was foaming. She arrived at the hospital two hours after the ingestion. On admission, she was conscious, cooperated and orientated. Her vital signs were as follows; blood pressure 130 / 80 mmHg, pulse rate 115 beats/min, respiratory rate 26 breaths/min, temperature 36.7 OC, and oxygen saturation 98 %. She was slightly dyspneic. Her Glasgow Coma Scale (GCS) was 15 (E4V5M6). Her oral intake was stopped. A peripheral intravenous line was inserted and rehydration with 0.9 % sodium chloride intravenous infusion was started. Oxygen was also applied via a nasal cannula. Her laryngoscopic exam revealed hyperemia in the oropharynx, rubor and slight edema in the larynx. 8 mg of dexamethasone sodium phosphate was administered intravenously to relieve the edema in the oropharynx and larynx. Her dyspnea improved a few minutes after the injection. The electrocardiogram and chest X-ray were normal and analysis of arterial blood gases showed a normal acid-base balance. Her blood tests were within normal ranges except the aPTT value (27 seconds) and prothrombin time (13.3 seconds). Emergency endoscopy was performed at the fourth hour of ingestion. Esophagogastroduodenoscopy revealed multiple superficial (Grade I) lesions on the esophagus, cardia, fundus, corpus and antrum of the stomach. The antrum was also slightly edematous. The lesions were considered as caustic injuries consistent with BAC solution ingestion. Endoscopic evaluation of the pylor and duodenum were not possible due to patient intolerance. Following the procedure, gastric lavage was performed. Further treatment consisted of parenteral nutrition, proton-pump inhibitor (intravenous pantoprazole 80 mg/day) and prophylactic antibiotic therapy (intravenous ampicillin and sulbactam, 2 gram every 12 hours for 5 days).

During the hospitalization period, the patient's vital signs were considered to be stable

and physical examination was normal. The patient was discharged after two hours of monitorization. She was recommended to start oral intake with liquids and to change over to a normal diet gradually. She was advised to continue pantoprazole for a month. A follow-up visit was scheduled for a week after discharge. Dysphagia had disappeared and physical examination remained normal, Oral pantoprazole therapy was continued for a month. Endoscopic control performed 3 months after ingestion showed complete healing of the lesions and showed no pathologic findings.

### Discussion

BAC is a cationic detergent with a very slow turnover. Due to widespread usage of BAC solutions, accidental ingestion that cause important side effects may occur. The toxicity, is time and dose dependent.<sup>5</sup> Aqueous solutions of BAC vary from neutral to slightly alkaline. As the characteristic of alkaline substances, they adhere to the mucous membrane, lead to increasing damage by prolonged contact with the mucosa. Thus, the concentration of BAC solutions is important in clinical use. Although BAC is effective at exceptionally low concentrations<sup>2</sup>, medical staff may fear using diluted BAC solutions due to the following reasons: as with antibiotics, the usage at sub-inhibitory concentrations of biocides to be used at recommended dilutions and contact time to ensure effective disinfection can potentially result in resistant organisms. Moreover, studies show that when used in sub-inhibitory concentrations, BAC solutions may result in increased resistance in *Pseudomonas aeruginosa*.<sup>6</sup> However, according to toxicology studies, solutions of 10 % or more are toxic to humans, cause skin and mucosa irritation, chemical burns and death if taken internally.<sup>4</sup> Warning signs of BAC solution toxicity include nausea, vomiting, restlessness, apprehension, dysphagia and dyspnea. Other toxic effects associated with oral doses include central nervous system depression, muscular weakness, corrosive injuries to the gastro-intestinal tract, kidney damage and death. Prognosis depends on the dose ingested and how quickly treatment is received. Early medical attention results in better

prognosis and the outcome depend on the extent of this damage. Damage continues to occur at the esophagus and stomach for several weeks after the solution was ingested.

Treatment schemes for caustic injuries with various concentrations of BAC solutions depend on the patient's general medical condition, local irritation and severity of lesions and complications in the gastrointestinal tract. The spectrum of treatment changes from supportive therapy to immediate emergency interventions and medications, managing complications or surgery.

Endoscopy is essential for the initial evaluation of location and severity of the gastrointestinal tract injuries in ingestion of the caustic substances like BAC solutions. Optimal timing for emergency endoscopy is recommended within 12 hours and no later than 24 hours after caustic ingestion.<sup>7</sup> Immediate endoscopic evaluation may miss the extent or depth of the lesions in the gastrointestinal tract. Injury with caustics proceeds to ulceration through inflammation, vascular thrombosis and fibrin crust within the first week after ingestion. In the healing process, granulation tissue formation with collagen deposition appears between weeks 2-3. This new tissue is weaker than normal tissue. Thus, there is an increased risk of perforation during endoscopic evaluation and predisposition to spontaneous esophageal rupture in endoscopies performed later than 24 hours and within the next few weeks after ingestion. Therefore, as a convenient timing, our patient underwent endoscopy after the fourth hour of the ingestion and an esophagogastroduodenoscopy was scheduled for three months after the incident for safe endoscopic control.

Corrosive esophageal injuries can result in stenosis.<sup>8</sup> BAC can act as a topical neurotoxin resulting in distal esophageal aganglionosis characterized by distal narrowing, proximal dilatation causing decreased food intake.<sup>9</sup> The role of steroids in the treatment of corrosive injuries caused by BAC ingestion has not been well established yet. However, evidence supports that

steroids decrease stricture formation in grade 2 injuries in humans.<sup>10</sup> Our patient had dysphagia and was slightly dyspneic due to irritation and sub mucosal edema in the oropharynx and larynx. Intravenous administration of dexamethasone sodium relieved these symptoms in our patient. Allergic reactions may also appear with ingestion of caustic agents. It is not clear whether the symptoms in BAC poisoning are related to irritation and the chemical effects of the solution or to an allergic hypersensitivity reaction. Prophylactic antibiotics were administered regarding the risk of infection linked to caustic injuries and steroid use. Oral treatment with a proton-pump inhibitor was started for symptomatic and curative relief for injured mucous membranes and was continued for a month. In conclusion, difficulties in managing emergencies with caustics are encountered in clinical practice. Medical staff should be educated in regard to safe storage of caustic agents. The ingestion of caustics like BAC solutions may induce a wide range of injuries in the gastrointestinal tract, which can be mild or fatal. Our aim in reporting this case of severe exposure to concentrated BAC solution was to improve the management of similar situations.

## References

1. Von Berkel M, Wolf FA. Survival after acute BAC poisoning. *Hum Toxicol* 1988;7:191-3.
2. Marple B, Roland P, Benninger M. Safety review of benzalkonium chloride used as a preservative in intranasal solutions: an overview of conflicting data and opinions. *Otolaryngol Head Neck Surg* 2004;130:131-41.
3. Hitosugi M, Maruyama K, Takatsu A. A case of fatal benzalkonium chloride poisoning. *Int J Legal Med* 1998;111:265-6.
4. Seymour Stanton Block. *Disinfection, Sterilization, and Preservation*. 5th ed. 2001. Lippincott Williams & Wilkins:311.
5. Pozarowski P, Pozarowska D. Benzalkonium chloride (BAK) induces apoptosis or necrosis, but has no major influence on the cell cycle of Jurkat

cells. *Folia Histochemica et Cytobiologica* 2011;49:225–30.

6. Mc Cay PH, Ocampo-Sosa AA, Fleming GT. Effect of subinhibitory concentrations of benzalkonium chloride on the competitiveness of *Pseudomonas aeruginosa* grown in continuous culture. *Microbiology* 2010;156:30-8.

7. Lupa,M, Magne J, Guarisco JL, Amedee R. Update on the diagnosis and treatment of caustic. *Ingestion J* 2009;9(2):54–9.

8. Turan C, Ozkan U, Ozokutan BH, Ozdemir M, Okur H, Küçükaydin M. Corrosive injuries of the esophagus in newborns. *Pediatr Surg Int* 2000;16:483-4.

9. Goto S, Grosfeld JL. The effect of a neurotoxin (benzalkonium chloride) on the lower esophagus. *Surg Res* 1989;47:117-9.

10.Schaffer SB, Hebert AF. Caustic ingestion. *J La State Med Soc* 2000;152:590–6.