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# pH - neutralizing esophageal irrigations as a novel mitigation strategy for button battery injury

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## Abstract

### Objectives/Hypothesis

Ingestion of button batteries (BB) can rapidly lead to caustic esophageal injury in infants and children, resulting in significant morbidity and mortality. To identify novel mitigation strategies, we tested common weakly acidic household beverages, viscous liquids, and Carafate® for their ability to act as protective esophageal irrigations until endoscopic removal of the BB.

### Study Design

Cadaveric and live animal model.

### Methods

Apple juice, orange juice, Gatorade®, POWERADE®, pure honey, pure maple syrup, and Carafate® were screened using a 3 V lithium (3 V - CR2032) BB on cadaveric porcine esophagus. The most promising in vitro options were tested against a saline control in live American Yorkshire piglets with anode - facing placement of the BB on the posterior wall of the proximal esophagus for 60 minutes. BB voltage and tissue pH were measured before battery placement and after removal. The 10 mL irrigations occurred every 10 minutes from t = 5 minutes. Gross and histologic assessment was performed on the esophagus of piglets euthanized  $7 \pm 0.5$  days following BB exposure.

## Results

Honey and Carafate® demonstrated to a significant degree the most protective effects in vitro and in vivo. Both neutralized the tissue pH increase and created more localized and superficial injuries; observed in vivo was a decrease in both full - thickness injury (i.e., shallower depths of necrotic and granulation tissue) and outward extension of injury in the deep muscle beyond surface ulcer margins ( $P < .05$ ).

## Conclusions

In the crucial period between BB ingestion and endoscopic removal, early and frequent ingestion of honey in the household setting and Carafate® in the clinical setting has the potential to reduce injury severity and improve patient outcomes.

## Level of Evidence

NA *Laryngoscope*, 2018



### Early View

Online Version of Record before inclusion in an issue

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### Metrics



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## Keywords

Foreign body

button battery

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prevention

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