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Simultaneous internal and external chemical injuries

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ABSTRACT

Chemical injuries from household products cause significant morbidity and mortality annually in pediatric patients. We present a rare case of a 21-month-old male with significant esophageal and cutaneous chemical burns secondary to non-accidental trauma. Given the unique challenges associated with multiple burn types we describe this case and provide a current review of the literature on the management of these potentially devastating injuries.

1. Introduction

Ingestion of caustic substances by pediatric patients comprises a major health concern as it can lead to devastating injuries. According to the 2012 Annual Report of the American Association of Poison Control Centers' National Poison Data System there were 111,148 instances of exposure to household cleaning agents by children age five years and younger making this the third most common substance exposure in this population [1]. We present a complex case of an ingested chemical burn leading to a complex dermal injury. To our knowledge there have been no previous similar reports.

Since both chemical ingestion and cutaneous injuries present a variety of dilemmas to the managing clinician, a discussion of the management of such injuries is provided based on literature review and our own experience.

2. Case report

A 21 month old male child ingested an alkali drain cleaner at home and his mother immediately induced emesis causing exposure of the substance onto his left torso and left thigh. He was taken to a local hospital via emergency medical services (EMS) and was found to have stridor and grunting in addition to significant burns on his torso and left thigh totaling about 8% TBSA (total body surface area) full thickness burns (Fig. 1). He was intubated and air-transported to an American Burn Association (ABA) verified Pediatric Burn Center for further management. After initial assessment in the Emergency Department he was immediately admitted to the Pediatric Intensive Care Unit for stabilization and resuscitation.

2.1. Operative findings

He was taken the operating room (OR) shortly after admission for bronchoscopy, esophagogastroduodenoscopy (EGD) and cutaneous wound care. On evaluation: both lips and his tongue had burns with ulcerations. The trachea was hyperemic but there was no evidence of injury to the airway. EGD noted an edematous oropharynx with white plaques and marked edema of the proximal esophagus. A circumferential white, adherent plaque was noted throughout the remainder of the esophagus indicative of a significant mucosal injury. No evidence of perforation was identified. A portion of the greater curvature and posterior wall of the stomach was also noted to be gray with an ischemic appearance of the mucosa. According to the Zargar classification system, this would classify as a combination of Grade 3 [16].

Due to the extensive injuries, an 18-French Stamm gastrostomy tube (G-tube) with a *trans*-gastric-esophageal-nasal string was placed to aid in future dilations as necessary. Placement of the gastrostomy tube was challenging given the cutaneous burns of the abdomen. The cutaneous burns were surgically debrided and Xeroform® with Neosporin® dressings were applied. Empiric antibiotic coverage was also initiated.

He returned to the OR on hospital day three and underwent further debridement of the cutaneous thermal wounds and a split-thickness

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Fig. 1. Image demonstrating the external caustic injury.

skin graft was placed covering approximately 5% TBSA. Porcine Xenograft (EZ-Derm®) was applied to the remaining 3% TBSA partial thickness burns.

2.2. Clinical course

A jejunostomy tube (j-tube) was placed through his gastrostomy tube and tube feeds were initiated on hospital day three. On hospital day seven he underwent direct laryngoscopy and repeat bronchoscopy showing multiple soft palate and supra-glottic burn injuries, superficial bilateral vocal cord erythema with overlying bilateral vocal cord granulation, however normal vocal cord mobility.

He was extubated on hospital day 8 and underwent upper gastrointestinal contrast study demonstrating a mild narrowing of the proximal and mid esophagus along with esophagitis. He was transferred out of the intensive care unit (ICU) on hospital day nine.

An esophagram on post-operative day (POD) #24 showed narrowing with a stricture in the cervical and distal esophagus (Fig. 2). Several episodes of high-grade gastro-esophageal reflux were also noted. Following this finding, esophageal dilation was conducted by interventional radiology (IR).

Unfortunately it was determined that his injuries were non-accidental and the patient was discharged to a foster home on hospital day 33 with cycled tube feeds, pureed oral diet, and planned repeated dilations with IR.

2.3. Readmission and complications

Four days after his second dilatation, the patient was brought back into the emergency department for fevers and hematemesis. An esophagram showed a contained leak at the mid-to distal esophagus. His oral feedings were stopped, broad-spectrum antibiotics were started and j-tube feeds were advanced to goal. A repeat esophagram seven days later showed no further leak. He recovered quickly and was discharged home on tube feeds.

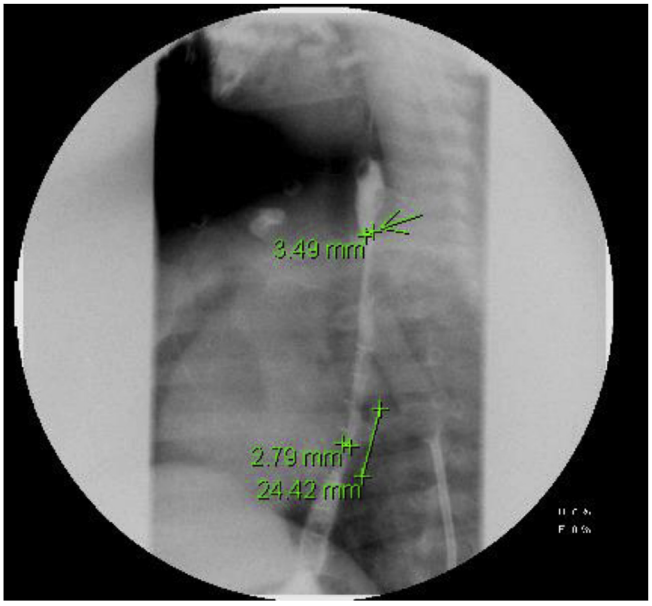

Fig. 2. Upper gastrointestinal contrast study demonstrating the esophageal strictures.

He continued to receive IR dilations, which resumed one month after perforation. Mitomycin® injections/application were added to the dilations three months later (during the fifth dilatation and continued for five consecutive dilatations). A total of 13 dilatations were performed over an 11-month period after the injury. With time, the patient began to regain complete oral food tolerance, which appeared to last for increasingly longer intervals between dilations.

However, the patient's symptoms due to recurrences of strictures persisted, and it was decided to perform an esophageal replacement with colonic interposition. His esophageal replacement surgery was performed successfully one year after injury and he is presently symptom-free.

His most recent follow up, 16 months after injury, showed complete healing of the superficial burns and grafting sites. He developed hypertrophic scarring which is improving after making adjustments to his custom-made compression garments. The compression treatment has had its own challenges due to the patient's g-tube position being adjacent to areas of the burns and the need to initially accommodate a *trans*-gastric-esophageal-nasal string and then j-tube. Finally, the g tube was removed and garment fitting was excellent. The need for surgical scar revision in the future is still a possibility. He continues to grow appropriately and is engaged in normal activities. Upon his most recent visit he has no food or activity restriction and has full range of motion and no apparent contractures.

3. Discussion

3.1. Etiology and pathophysiology

Ingestion of caustic substances and chemical burns in the pediatric population is not an uncommon event and can lead to devastating results mostly from significant scarring and stricture formation, but also death. In the 2012 report of the American Association of Poison Control Centers, there were nearly 2.4 million toxic exposures, 83.4% of which were exposure from ingestion and 7% were from dermal exposure [1]. Household cleaning substances were the third most offending agent and were involved in over 193,000 exposures [1]. In children five years and younger, household cleaners accounted for over 111,000 cases and 2 out of 34 toxin related fatalities [1]. Of those exposures, acid drain cleaners led to 53 incidents and alkali cleaners led to 441 incidents [1].