Laundry Detergent Pod Ingestions: Is There a Need for Endoscopy?

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Abstract

Introduction Laundry detergent pod (LDP) exposures in children have resulted in several referrals to the emergency department. Signs and symptoms can include gastrointestinal symptoms (vomiting, drooling), neurological symptoms (depressed sensorium), or metabolic changes (lactic acidosis). There is limited literature on esophageal injury following LDP ingestions.

Case Series We reviewed three cases of pediatric LDP ingestions that underwent an upper endoscopy in a tertiary care pediatric hospital. All of our patients were younger than 3 years old. The upper endoscopies revealed superficial esophageal erosions in two patients and erythema in the other. None of the patients had oral burns. Two of them developed swallowing dysfunction. Follow-up upper GI studies were normal.

Case Discussion Our three patients ingested laundry detergent pods and all of them developed some degree of esophageal injury despite the absence of oral erythema, ulcers, or swelling. A review of literature suggests LDP exposures are more severe than non-pod detergents. Reasons as to why this may be remain unclear, although investigation into the ingredients and mode of delivery may help us to better understand. In a literature review, no esophageal strictures have been reported after LDP ingestion. We reviewed esophageal injury classification systems in an attempt to predict who may be at greatest risk for stricture based on initial findings.

Conclusion Our case series demonstrates it is hard to predict esophageal injury based on signs and symptoms. Based on a literature review, long-term esophageal stricture is unlikely,

but if gastrointestinal symptoms persist, it is reasonable to evaluate with an upper endoscopy. Larger studies are needed.

Keywords Laundry detergent pods · Tide pods · Esophageal injury · Esophageal stricture · Single-use detergent sacs

Introduction

Laundry detergent pod (LDP) ingestions have become an area of concern within the US pediatric medical community since their naissance in 2010. In 2012, the Center for Disease Control published data collected from the Carolinas Poison Control and the Children's Hospital of Philadelphia Poison Control Center. Over a 1-month period, they found 485 laundry detergent pod exposures. Most of the patients were less than 5 years of age (94 %), highlighting the importance of pediatrician awareness [1]. There have been several reviews that have compared LDP to non-pod detergent ingestions and found the clinical manifestations of LDPs to be more severe [2]. Some of the symptoms of LDP ingestions include gastrointestinal symptoms, such as nausea, vomiting, drooling, and swallowing dysfunction; pulmonary symptoms, such as choking, coughing, increased work of breathing, and respiratory failure; metabolic acidosis; and altered mental status. Few of the studies we have reviewed have focused on endoscopic findings secondary to pod ingestions. There is no consensus as to whether or not these patients should undergo endoscopy to evaluate for esophageal injury. In this paper, we present three cases of LDP ingestions at Children's of Alabama and highlight the differences in their clinical presentations. The purpose of our manuscript is to discuss our endoscopic results following LDP ingestions and consider if there is any potential for long-term esophageal sequelae.

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Case 1

A 13-month-old, 10-kg, male with no past medical history presented to the emergency department (ED) 1 hour after ingesting an All Mighty Pack®. His father found him in the laundry room with the container of detergent pods. He looked in his mouth and saw the pod dissolving. The child began vomiting shortly thereafter and became difficult to arouse. His father promptly took him to the ED. On the way to the ED, the child began to have audible inspiratory stridor. In the ED, his vital signs were as follows: pulse 148 beats per minute (bpm), blood pressure 138/86 mmHg, oral temperature 97.8 °F, respiratory rate 28 breaths per minute, and oxygen saturation of 98 % on room air. On the physician's exam, the infant was in acute distress, with audible stridor, grunting, and diffuse crackles. He had no oropharyngeal burns or edema noted. Labs obtained showed his venous blood gas was as follows: pH 7.32, bicarbonate 16.2 mmol/L, lactate 8 mmol/L (normal <2.1 mmol/L). His complete blood cell count showed a normal white blood cell count of 9,300/uL and platelets of 256,000/uL. His glucose was elevated at 199 mg/dL. Due to his deteriorating respiratory and neurologic status, the patient was intubated through rapid sequence and transferred to the pediatric intensive care unit. Overnight, he was febrile to a maximum of 102.2 °F. Within 8 hours, his acidosis worsened, with a pH 7.1, bicarbonate 15 mmol/L, and a base deficit of 12 mmol/L. His heart rate was 220 bpm, and he had a significantly delayed capillary refill. He was empirically started on vancomycin and piperacillin-tazobactam and aggressively hydrated.

The pediatric pulmonary and gastroenterology teams were consulted after he was stabilized. Bronchoscopy showed tracheal edema and secretions in both the left and right lobes. No

foreign body was visualized. Esophagogastroduodenoscopy showed superficial erosions throughout the esophagus (Fig. 1). His stomach and duodenal mucosa were normal. The patient was aggressively resuscitated, and throughout the following day, his lactate normalized. Blood cultures remained negative. Thin-layer chromatography was only significant for ranitidine. He was extubated and transferred to the floor. Modified barium swallow showed silent aspiration of thin and nectar consistencies. He was discharged after 8 days in the hospital with a steroid taper and thickened feeds. A follow-up barium swallow 1 week after discharge showed no improvement.

Two weeks later, he returned to the ED with respiratory distress. He had completed his steroid taper 7 days prior. Mom noticed that over the past week, his breathing progressively worsened and he was refusing to eat. He went to his pediatrician the day before admission and was started on albuterol every 4 hours, but his symptoms did not improve. In the ED, his exam showed a pulse of 164 bpm, rectal temperature 100.0 °F, respiratory rate of 40 breaths per minute, and oxygen saturation of 92 % on room air. He was in acute distress and agitated. On lung exam, he had diffuse wheezing. A chest radiograph obtained was concerning for chronic aspiration versus a viral process. His venous blood gas showed a pH 7.45, bicarbonate 18.7 mmol/L, lactate 1.4 mmol/L, glucose 114 mg/dL, and a normal WBC count. He was admitted overnight but never required oxygen. The pulmonologist was consulted and felt this could be pneumonitis after steroid removal versus acute bronchiolitis in addition to his recent lung injury. He recommended fluticasone and a 12-day steroid taper.

Six weeks after the inciting event he had an upper GI series that was normal. A repeat EGD 2 months after the initial event showed grossly normal mucosa. He did not show up for his

Fig. 1 Esophagitis secondary to pod ingestion

follow-up modified barium swallow or his pulmonary and GI appointments.

Case 2

A 2-year-old male ingested a Tide Pod® at home. His mother found him with an empty Tide® packet and detergent on his face and clothes. She called poison control who recommended giving him sips of water and to call back if any symptoms developed. Forty-five minutes after the ingestion, he developed non-bilious, non-bloody emesis. He was taken to the ED where he continued to throw up. Vital signs showed a blood pressure of 99/68 mmHg, pulse 120 beats per minute, oral temperature 98 °F, respiratory rate of 32 breaths per minute, and an oxygen saturation of 98 % on room air. No visible oral ulcers. Labs did not show an acidosis, and his glucose was 77mg/dL. Chest radiograph showed lung hypoaeration. He was admitted for IV hydration. Given his persistent vomiting, an upper endoscopy was performed which showed superficial mucosal sloughing throughout the esophagus (Fig. 2). His gastric mucosa was normal. He was discharged home within 36 hours on sucralfate and omeprazole. Four weeks later, the patient was asymptomatic and an upper GI series was normal.

Case 3

A 3-year-old male with no past medical history bit into an All Mighty Pack® while in the kitchen. His father entered the room and saw the half-eaten pod. He called poison control and was instructed to give the child water, but the child refused

and began acting lethargic. As the father was driving him to the ED, he started to hear wheezing and saw his son was developing perioral cyanosis. He was difficult to arouse. His father subsequently pulled over and called 911. In the ED, he remained lethargic, but was breathing on his own without oxygen. His oxygen saturation was 97 % on room air, blood pressure was 82/45 mmHg, pulse 89 beats per minute, oral temperature was 98.6 °F, and a respiratory rate of 24 breaths per minute. He was drooling, without visible oral ulcers. His renal panel showed bicarbonate of 13 mmol/L, an anion gap of 26, and glucose of 159 mg/dL. A venous blood gas revealed pH 7.28, bicarbonate of 16 mmol/L, and lactic acid of 13.5 mmol/L. He was admitted, fluid-resuscitated, and observed overnight. He never required ventilatory assistance. The following day, his acidosis resolved. He had persistent drooling, and thus, an upper endoscopy was performed. It revealed very mild proximal erythema in the esophagus (Fig. 3), but was otherwise normal. After adequate oral intake, he was discharged home on sucralfate and omeprazole. He had a follow-up appointment 4 weeks later where mom stated the drooling did not resolve until 3 days after discharge. At this time, his oral intake was not back to baseline. An upper GI series did not reveal any abnormalities. A follow-up appointment was scheduled to discuss possible repeat endoscopy but the patient did not show up to his appointment.

Discussion

Laundry detergent pods have been in use in the USA since 2010. They have been available in Europe, however, for at least a decade. Most of the exposures have been ingestions,

Fig. 2 Sloughing of the superficial mucosa throughout the esophagus

Fig. 3 Mild proximal esophageal erythema

leading to several typical symptoms. A study in the UK reported 1,215 ingestions from May, 2009 to July, 2012 and showed that the most common symptoms were nausea and vomiting (59.3 %), coughing (4.4 %), and drowsiness (4.0 %) [3]. In the USA, the Centers for Disease Control (CDC) summarized information available regarding pod ingestions from May to June, 2012. They found 485 patients, in which 80 % were symptomatic. Similar to the UK study, 55 % had vomiting, 15 % had coughing or choking, 6 % had nausea, and 7 % had drowsiness [1]. A true set of criteria to assess the severity of laundry detergent pod ingestions has yet to be determined [4]. In our discussion, we will review possible reasons for more impressive signs and symptoms with LDPs compared to non-pod detergents. We will highlight the few studies that have discussed the endoscopic findings and swallowing dysfunction found with pod ingestions. And lastly, we will attempt to determine if there are potential long-term esophageal sequelae after pod ingestions.

Traditional laundry detergent has been shown to have less signs and symptoms compared to LDPs. In the CDC review, LDP exposures were significantly more likely than non-pod detergent exposures to result in a minor, moderate, or major medical outcome ($p < 0.001$), including vomiting ($p < 0.001$), coughing ($p = 0.048$), and drowsiness ($p < 0.001$) [1]. We compared LDPs to non-pod detergents in an attempt to understand why LDPs produce more signs and symptoms. Interestingly, in reviewing the data safety sheets of All®, Tide®, and Purex®, the non-pod laundry detergents were more alkaline (pH 9.53, pH 8.1–8.6, pH 10.1–11.1, respectively) than the laundry detergent pods (pH 7.6, pH 6.8–7.4, pH 8–11, respectively) [5–10]. Thus, perhaps the more impressive symptoms of vomiting, lactic acidosis, and CNS depression are secondary to the ingredients or the mode of delivery. One ingredient that is found in many LDPs but less in non-pod detergents is propylene glycol. Propylene glycol has a weight composition of 7–13 % in Tide Pods®, 5–15 % of Purex UltraPacks®, and 7–13 % in All Mighty Packs® [5, 8, 10]. We could not find a weight composition within the non-pod laundry detergents. Propylene glycol is primarily metabolized by the liver, producing lactate, acetate, and pyruvate [11]. This may explain the lactic acidosis seen in LDP ingestions. Some

studies have attributed propylene glycol to CNS depression and lactic acidosis [11], while others remain skeptical of the claims [12].

Alcohol ethoxylates are another ingredient that has a greater percentage of weight composition in LDPs compared to non-pod detergents. For example, Tide Pods® have a 10–30 % weight composition while Tide® detergent has a 1–5 % weight composition. Alcohol ethoxylates are non-ionic surfactants. The safety data available shows limited evidence in rodent studies that alcohol ethoxylates are harmful; however, at high doses, ingestion can produce vomiting, diarrhea, lethargy, and increased work of breathing [13]. Alternatively, perhaps part of the increase in signs and symptoms is secondary to the ease in consuming larger quantities with prepackaged LDPs.

There is limited literature discussing esophageal injuries and swallowing dysfunction after pod ingestions. A review of 17 symptomatic pediatric patients in Trieste, Italy, showed only one patient had oral burns on physical exam. Five of these patients underwent an endoscopy for undisclosed reasons. Three had esophageal erythema, one had pseudomembranous lesions, and another had esophageal ulcers. None of the patients had esophageal stenosis at follow-up [14]. Another UK study by Williams et al. showed only 0.8 % ($n = 4,518$) had pharyngitis and esophagitis. They also reported only one patient had esophageal “blistering” of the esophagus that resolved on repeat endoscopy 7 days later [15].

Other case reports have demonstrated that some patients can have swallowing dysfunction as a result of LDP ingestions. For example, a case report presented by Schneir et al. discussed the hospital course of a patient after a pod ingestion. The patient had an endoscopy that showed mild esophageal erythema and a raised distal esophageal lesion of unknown significance. A fluoroscopic swallowing study was performed a week after the incident which showed aspiration on nectar-thick liquids. A follow up study 1 month later demonstrated complete resolution [16]. Beuhler et al. also demonstrated swallowing dysfunction. Their case series revealed that two of the four patients required nasogastric tube feeds in addition to thickened oral feeds [17].

Our three patients ingested laundry detergent pods and all of them developed some degree of esophageal injury and two

of them developed swallowing dysfunction. Of note, none of our patients had oral erythema, swelling, or ulcers. Case 1 required intubation, had a significantly elevated lactate level, and an altered mental status. His upper endoscopy revealed esophagitis, and his modified barium swallow displayed silent aspiration, requiring thickened feeds. The second case showed no acidosis, no altered mental status, and no oxygen requirement, yet his esophagus was the most notable, showing sloughing of the superficial mucosa. Case 3 had an impressive lactate, altered mental status, and drooling that lasted for several days. His endoscopy revealed the least-impressive injury.

Lastly, is endoscopy necessary in these patients? In our literature review, we have not been able to find any cases of esophageal stricture after laundry detergent pod ingestions. However, several cases, including our own, have been lost to follow-up. The only case series that showed a structural change was published by Fraser et al., who revealed webbing of the vocal cords. This report looked at five pediatric patients, all of whom developed edema of the airway. One of them developed webbing of the anterior commissure of the vocal cords and required surgical intervention [18].

Without evidence of stenosis, we looked to the Zargar classification system of caustic esophageal injury to see if we could predict those who would be at risk for developing strictures. According to the study done by Zargar et al., after evaluating 381 endoscopic exams for various caustic ingestions, patients with grade 0, 1, or 2a had no further sequelae, whereas those with grade 2b or above were more likely to develop problems. Approximately seventy-one percent of patients with grade 2b developed strictures requiring intervention. In addition, the study did not show a correlation between oropharyngeal findings and upper gastrointestinal findings [19]. Knowing the grade of esophageal injury can help determine the likelihood of future stricture formation. In a large analysis of several studies, Contini et al. found that it usually takes 8 weeks for stricture formation but it can occur sooner or take up to one year [20]. In our case series, cases 1 and 2 had a grade 2a injury, whereas case 3 had a grade 1 injury. According to the Zargar classification, our patients are unlikely to develop long-term complications.

Conclusion

We report three cases of LDP ingestions in which endoscopy demonstrated esophageal injury. It may be hard to predict who will have worse esophageal injury by signs and symptoms. In addition, the lack of oral swelling or lesions does not rule out esophageal injury. If a patient presents with significant gastrointestinal symptoms, including persistent vomiting, dysphagia, drooling, or oral

aversion, it is reasonable to evaluate with an upper endoscopy. Given the limited information available and the Zargar classification, it appears there is a low likelihood of developing long-term esophageal sequelae in LDP ingestions; however, larger studies are needed.

Conflicts of Interest No funding for this case series. No conflicts of interest by any of the authors. This manuscript has not been presented to any conference as of April 15, 2014.

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