Ingestion of laundry detergent packets is an important threat to young children. Because of their developmental stage, toddlers are prone to place these small, colorful packets in their mouths. The packets can easily burst, sending a large volume of viscous, alkaline liquid throughout the oropharynx. Ingestion causes major toxic effects, including depression of the central nervous system, metabolic acidosis, respiratory distress, and dysphagia. Critical care nurses should anticipate these clinical effects and facilitate prompt intervention. Increased understanding of the risks and clinical effects of ingestion of laundry detergent packets will better prepare critical care nurses to provide care for these children. (Critical Care Nurse. 2016;36[4]:70-75)

Laundry detergent packets are a marked risk for children whose developmental stage makes them prone to place the small colorful objects in their mouth. Ingestion of laundry detergent packets causes respiratory compromise, lethargy, nausea, vomiting, diarrhea, mucosal damage, and metabolic acidosis. Critical care nurses caring for children who have ingested laundry detergent packets should be aware of the potential for rapid deterioration in respiratory and mental status that requires prompt intervention. Additionally, nurses should anticipate the possibility of prolonged effects from mucosal damage and swelling in the oropharyngeal space. By anticipating the effects of the ingestion, nurses can intervene quickly to provide the best care possible for these children.

Background

Laundry detergent packets were introduced into the US market in 2012. The small packets are containers of concentrated detergent encased in a water-soluble membrane for a single load of laundry. They are known by a number of different names, which are specific to the manufacturer and the chemical preparation; Tide Pods, All Mighty Pacs, and Gain Flings are shown in the Figure. Packets have become popular because of their convenience compared with that of traditionally packaged laundry detergent. Their bright and colorful markings make them appear candylike, appealing to toddlers and small children, who are prone to play with and ingest or burst the packets, exposing themselves to the contents. Although children less than 5 years old are considered at risk, children less than 3 years old account for...
the greatest number of exposures because of the younger children’s natural tendency to explore the environment by placing objects in the mouth.11 Reports of substantial toxic effects after ingestion or exposure highlight the risk that laundry detergent packets pose to children.1-10

From March 2012 to April 2013, a total of 17,230 exposures of children to laundry detergent packets were reported to the National Poison Data System.1 The number includes ocular and dermal exposures, ingestions, and aspiration.1 Rates of exposure were highest in 1- to 2-year-olds, accounting for 64.8% of all exposures.1 The most common route of exposure was ingestion alone (without any additional routes of exposure such as ocular or dermal exposure), which accounted for 79.7% of exposures; an additional 10.4% of exposures occurred via multiple routes.1 Of all children evaluated at a health care facility, children younger than 3 years or those who were exposed via ingestion were the ones most frequently admitted.1 Among children evaluated because of ingestion, almost 13% required hospital admission.1 Ingestion of laundry detergent packets is associated with a higher risk than are other routes of exposure.1,7

In data reported to the Virginia Poison Center,7 among children admitted to the hospital, 67% required intubation for central nervous system (CNS) depression, respiratory concerns, or both. Evidence of involvement of the upper part of the airway, such as stridor and drooling, was reported in 56% of cases, whereas evidence of involvement of the lower part of the airway, such as abnormal findings on lung examination, retractions, and respiratory distress, was reported in 33%. A total of 78% of patients had severe vomiting, and 22% experienced CNS depression. Additional serious reactions included gastric burns, seizures, hematemesis, pulmonary edema, bradycardia, and respiratory arrest. In 2013, two deaths due to exposure to the packets were reported, one in a 7-month-old boy and one in a 16-month-old boy.1

Laundry detergent packets were available in the European market more than 10 years earlier than in the United States, and statistics on ingestion among European children mirror those in the United States.2,3 Results of a national poison center study from the United Kingdom indicated that exposures to laundry detergent packets were the highest proportion of exposures to household cleaning products; 96% of the exposures occurred in children less than 5 years old, and 80% occurred via ingestion.2

Data from US and European studies2,3 indicated that compared with exposure to nonpacket forms of laundry detergents, ingestion of packets resulted in more signs and symptoms and increased emesis, drowsiness, coughing or choking, digestive signs and symptoms, and bronchospasm. In a comparison of exposures to packet and traditionally packaged laundry detergent reported to Texas poison centers,4 the proportion of packet exposures resulting in serious medical outcomes was more than 5 times that for exposures to traditionally packaged laundry detergent. The rates for all reported clinical effects were higher for patients exposed to packets than for those exposed to traditionally packaged laundry detergent. Surprisingly, no patients exposed to traditionally packaged detergent required intubation or had severe CNS depression, a complication that remains a major concern for patients exposed to packets.4 This finding highlights the added health risk posed by these relatively new products.

Toxicology

Several case reports5-10 have indicated the potential for marked toxic effects, including CNS depression, metabolic acidosis, pulmonary toxic effects, and swallowing difficulties after ingestion of laundry detergent packets.
packets. As mentioned, these signs and symptoms do not often occur with exposure to traditionally packaged laundry detergent, and the exact mechanisms of the added toxic effects remain unclear. Drawing definitive conclusions remains difficult because of variations among packets; proportions of major components are different for each manufacturer.

Several possibilities may explain the severity of the clinical signs and symptoms associated with the ingestion of packets. One possibility is propylene glycol, a component found in greater proportion in laundry detergent packets than in traditional packages. Upon ingestion, some propylene glycol is metabolized by the liver to form lactate, acetate, and pyruvate. This conversion to lactate transiently increases the serum levels of lactate, creating metabolic acidosis, which has been observed in several cases. The remainder of the drug is excreted unchanged in the urine, with renal clearance decreasing as the dose of propylene glycol increases. At higher doses, the ability of the proximal tubule to secrete the drug is exhausted and the propylene glycol remains in the blood longer. Because of this, the half-life of propylene glycol in infants and children is markedly longer than the half-life in adults; the mean half-life of 19.3 hours contributes to the propensity for toxic effects in younger patients.

Toxic effects of propylene glycol are characterized by development of serum hyperosmolality, lactic acidosis, renal failure, and CNS depression. However, Beuhler et al claim that the dose contained in a laundry detergent packet should not generate enough intoxication to produce the near-coma state reported after ingestion. A second possibility is ethoxylated alcohols. Ethoxylated alcohols are a predominate compound in laundry detergent packets and may cause sedative effects beyond the general effects of alcohol. Beuhler et al have proposed that these alcohols may account for the profound sedation observed after ingestion of laundry detergent packets. Animal studies have indicated that ingestion of relatively large doses of ethoxylated alcohols leads to profound sedation. The large doses may account for the CNS depression that occurs in children who ingest laundry detergent packets.

The final possibility is related to the higher viscosity of the contents of laundry detergent packets compared with the viscosity of the contents of traditionally packaged laundry detergent. Laundry detergent packets have a higher concentration of surfactants and ethoxylated alcohols that contribute to an increased viscosity when mixed with water. This viscous, caustic substance creates a chemical burn when it comes in contact with skin and mucous membranes and may account for the severity of airway, gastric, and corneal lesions.

**Clinical Effects**

Ingestions of laundry detergent packets differ from ingestions of traditionally packaged laundry detergent. The packets are likely to burst and spray contents throughout the oropharyngeal space when someone bites into them. This unique feature of the packets sends the more alkaline, more viscous detergent to further reaching anatomical locations than does ingestion of traditionally packaged detergent, most likely accounting for some of the clinical effects. This feature, coupled with absorption of the propylene glycol and ethoxylated alcohol in the detergent, probably contributes to the severity of illness in many children.

**Respiratory Compromise**

Immediate coughing and choking are common as packets burst and laundry detergent comes into contact with esophageal, laryngeal, or bronchial tissue. Radiographs of the airway reveal swelling and edema of the epiglottic and aryepiglottic folds. Swelling of these structures narrows the airway, placing the child at risk for respiratory failure due to obstruction of the airway. Additionally, the combination of emesis and decreased mental status places the child at risk for aspiration of gastric or packet contents, resulting in pneumonia or pneumonitis. Radiographic findings consistent with aspiration pneumonia have been detected in some instances. Hypoventilation and hypoxemia ensue, sometimes severe enough to necessitate mechanical ventilation. Additionally, bronchospasm and wheezing can occur, most likely related to inflammation of the lower parts of the airway.

**Lethargy**

Sudden profound lethargy is a unique feature of packet ingestion; it rarely occurs with ingestion of traditionally packaged laundry detergent; it rarely occurs with ingestion of traditionally packaged laundry detergent.
The mainstay of management of children who have ingested laundry detergent packets is supportive care and symptomatic management. Many case reports describe children rapidly progressing from irritability and lethargy to complete unresponsiveness and requiring intubation. In these patients, concerns for apnea or hypoventilation as well as ineffective coughing and gagging prompted intubation. In several instances, lethargy persisted for several days. In 1 case report, a child experienced lethargy, hypotonia, and diminished alertness and activity level that persisted for 7 to 10 days after ingestion. Electroencephalography and examination by a neurologist revealed no localizing neurological deficits. Upon reevaluation several weeks after discharge from the hospital, the child’s assessment findings had returned to baseline.

**Nausea, Vomiting, and Diarrhea**

Nausea, vomiting, and diarrhea are the most common signs and symptoms reported after ingestion of all household cleaning products, including laundry detergent packets. Vomiting is often the initial sign, frequently preceding or coinciding with CNS depression. The vomiting can be quite severe and may result in electrolyte abnormalities as well as dehydration. Although less common than vomiting, osmotic diarrhea sometimes contributes to the gastrointestinal distress associated with ingestion of laundry detergent packets.

**Mucosal Damage**

Because of their alkalinity, the contents of a laundry detergent packet also cause inflammation and mucosal damage, resulting in ulceration of oral, laryngeal, and esophageal tissue. In patients who had esophagogastroduodenoscopy, erythema and raised lesions were visible throughout the mucosa. Inflammation of the laryngeal and esophageal structures, essential for swallowing, speaking, and inspiration, leads to hoarseness, drooling, dysphagia, stridor, and respiratory distress. Therefore, the mucosal damage most likely accounts for some of the respiratory compromise and feeding and swallowing difficulties associated with ingestion of the packets. In some patients, dysphagia persists for days to weeks after the ingestion. These children require interventions for safe feeding, such as administration of thickened liquids or feeding via a nasogastric tube.

**Metabolic Acidosis**

Metabolic acidosis is common after ingestion of laundry detergent packets and most likely is related to conversion of propylene glycol to lactic acid. Additionally, hyperglycemia and renal insufficiency can occur. Renal insufficiency may be in part due to renal elimination of propylene glycol coupled with dehydration. Despite these reports, collection of laboratory data after ingestions of laundry detergent packets by children has been inconsistent, and further information is needed to assess the effects of the ingestions. Providers should be aware of electrolyte and metabolic derangements and the possibility of dehydration necessitating fluid administration.

**Nursing Implications**

The mainstay of management of children who have ingested laundry detergent packets is supportive care and symptomatic management as summarized in the Table. Interventions include invasive or noninvasive mechanical ventilation, intubation for airway protection, oxygen administration, hydration, use of bronchodilators, and gastric decompression. As providers at the bedside, nurses have the unique responsibility of monitoring for the most subtle changes in a patient’s status and facilitating quick intervention. Nurses caring for a child who has ingested a laundry detergent packet should be alert to the potential for rapid deterioration in the child’s clinical condition and should remain prepared to intervene as necessary.

Nurses should be aware of the potential for respiratory compromise and decline in responsiveness and should monitor for hypoxia, hypoventilation, aspiration, and inability to protect the airway. Continuous monitoring of respiratory rate and the results of pulse oximetry is essential. Noninvasive capnography monitoring may be useful in identifying hypoventilation. Nurses should assess for respiratory distress, wheezing, and stridor. Bronchodilators can be useful in patients with wheezing. Inhaled racemic epinephrine and dexamethasone can be helpful if edema of the upper part of the airway is a concern. Chest radiography may be considered for children with respiratory distress. Additionally, frequent monitoring of neurological status by determining the trend of the score on the Glasgow Coma Scale and assessing for coughing and gagging regularly are important in identifying...
children who can no longer protect their airway. A plan for intubation should be discussed early because patients may progress quickly to respiratory failure or unresponsiveness and require mechanical ventilation. Nurses can advocate for the use of invasive or noninvasive positive pressure ventilation when warranted.

Patients should be given nothing by mouth and should receive maintenance intravenous fluids until vomiting resolves. Gastric decompression may provide some relief for severe vomiting and may help reduce the risk for aspiration. Additional administration of fluids may be required to treat and prevent dehydration associated with severe vomiting. Results of laboratory metabolic panels should be assessed to help detect electrolyte abnormalities; hydration should also be assessed. Nurses should be aware of the possibility of long-lasting mucosal inflammation and difficulties swallowing and should assess safety of oral feedings before the feedings are started. Nurses can advocate for nasogastric or postpyloric feedings to provide nutrition until the child is able to safely feed by mouth.

Of note, these management recommendations address the observed clinical effects of exposure to the contents of laundry detergent packets. The interventions have not been explicitly studied in clinical trials or specifically evaluated in research on exposure to the contents of laundry detergent packets. Many of these interventions can have unintended detrimental effects; therefore, a risk-benefit analysis should be completed before each intervention.

### Education and Awareness

Health care providers have the opportunity to prevent exposures to the contents of laundry detergent packets through educational efforts focused on prevention. Exposures are a major risk for children and are a growing problem. According to poison control center data, exposures have nearly doubled since 2012. In 2015, a total of 12,594 exposures occurred in children less than 5 years old. Several organizations, including the American Association of Poison Control Centers, the Centers for Disease Control and Prevention, and the American

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**Table** Pathophysiological effects of ingestion of laundry detergent packets and suggested management by system

<table>
<thead>
<tr>
<th>System</th>
<th>Pathophysiology</th>
<th>Management</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular</td>
<td>Cardiovascular compromise may follow respiratory, neurological, or gastrointestinal effects or fluid and electrolyte disturbances</td>
<td>Monitor heart rate, blood pressure, and perfusion</td>
</tr>
<tr>
<td>Respiratory</td>
<td>Detergent packets burst, exposing the oropharyngeal mucosa to contents, leading to swelling and irritation Sedative effects, combined with nausea and vomiting, increase risk for aspiration Sedative effects may lead to apnea or hypventilation</td>
<td>Monitor work of breathing, respiratory rate, and pulse oximetry Consider noninvasive capnography monitoring Monitor for stridor and have racemic epinephrine and dexamethasone available Consider chest radiography Maintain plan for intubation</td>
</tr>
<tr>
<td>Neurological</td>
<td>Components of the detergent, specifically ethoxylated alcohol and propylene glycol, may produce marked lethargy, which can lead to hypoventilation, apnea, or inadequate secretion management Although the mechanism is poorly understood, seizures have been reported</td>
<td>Track trends in scores on Glasgow Coma Scale; consider intubation if score &lt; 8 Assess cough and gag reflex regularly Monitor for seizure activity</td>
</tr>
<tr>
<td>Gastrointestinal</td>
<td>Ingestion can lead to marked nausea and vomiting Oropharyngeal mucosal damage may lead to dysphagia</td>
<td>Maintain nothing by mouth Use gastric decompression Do a swallowing evaluation when appropriate Give nasogastric/postpyloric feedings if necessary</td>
</tr>
<tr>
<td>Fluid and electrolytes</td>
<td>Electrolyte disturbances and dehydration may result from vomiting as well as metabolism of propylene glycol</td>
<td>Administer maintenance intravenous fluids Monitor hydration status and consider additional fluid bolus Monitor results of laboratory metabolic panel</td>
</tr>
</tbody>
</table>

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*a Intervention recommendations are based on the observed clinical effects of ingestions. These interventions have not been specifically studied in regards to pediatric exposure to laundry detergent packets.*
Academy of Pediatrics, have launched campaigns to educate consumers about the risks associated with laundry detergent packets. Additionally, many manufacturers are now distributing packets in opaque containers with latches that are difficult for children to open.

Creating awareness among parents of young children is essential to reducing ingestions. Parents of young children, especially toddlers 1 to 2 years old, should be educated frequently about the risks associated with ingestions of laundry detergent packets and should be encouraged to store the packets out of the reach of children. Parents of especially high-risk children can be encouraged to temporarily use traditionally packaged laundry detergent until the children are developmentally less likely to place the packets in their mouth. Health care providers should encourage parents to seek medical attention quickly if a child might have ingested a laundry detergent packet.

Conclusion

The colorful appearance of laundry detergent packets makes them appealing to young children, who often explore the environment through oral play. When placed in the mouth, laundry detergent packets can burst and spray their contents throughout the oropharynx, causing mucosal irritation. Children may ingest or aspirate the contents, leading to marked toxic effects that often require admission to an intensive care unit, mechanical ventilation, and close monitoring. Pediatric critical care nurses should anticipate the clinical effects of ingestion of laundry detergent packets so the nurses can promptly intervene when needed. Prompt recognition of respiratory distress and changes in mental status are necessary to keep these children safe. Moreover, nurses can make an impact in preventing ingestions by educating families with young children on the risks associated with laundry detergent packets.

Financial Disclosures

None reported.

References

Ingestion of Laundry Detergent Packets in Children
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