Case report

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캡슐세제: 주목해야 할 가정내 중독의 원인

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Laundry detergent pod: a rising cause of household poisoning

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With the increasing use of laundry detergent pods (LDPs) in Korea, pediatricians and emergency physicians should recognize the risk of poisoning by ingestion of the pods. This report describes a 15-month-old boy who ingested an LDP at home. At the time of hospitalization, he was alert and hemodynamically stable. However, 3 hours after the ingestion, he developed drowsiness, respiratory distress, and metabolic acidosis. Despite the initial supportive therapy, the acidosis worsened, requiring continuous renal replacement therapy. Metabolic acidosis improved within 1 hour after initiation of the continuous renal replacement therapy. He was discharged uneventfully on day 13. At 1-month follow-up, he did not show any sequelae. This case highlights the need for recognition of the risk of poisoning by LDP.

Key words: Accidents; Child; Continuous Renal Replacement Therapy; Detergents; Poisoning

Introduction

Laundry detergent pod (LDP) is a household product that is increasingly used. The pod consists of a single dose of highly concentrated liquid detergent sealed within a water-soluble film. Most LDPs are small in size and colorful with a candy-like appearance, enticing children ingest them. In the United States, Europe, and Japan where LDPs were first used, the majority of pediatric poisoning occurs in children younger than 6 years[1-3]. This vulnerability of poisoning in young children may stem from the candy- or toy-like appearance of the pods. Although the use of the pods has been increasing in Korea since their first release in 2012, there are insufficient policies to prevent poisoning by the pods. It is essential to know the potential risk along with treatment options, clinical progress, and prognosis of LDP poisoning. However, there is a lack of pediatric reports on the poisoning in Korea. Herein, the author reports a case of Korean toddler who was hospitalized due to LDP poisoning. This study was approved by the institutional review board with a waiver for informed consent (IRB no. KNUCH 2020-11-008).

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Case

A previously healthy, 15-month-old boy was brought to the emergency department with vomiting after ingestion of one LDP at home. He had no specific past medical or family history. The initial vital signs were as follows: blood pressure, 94/48 mmHg; heart rate, 154 beats/min; respiratory rate, 38 breaths/min; temperature, 36.3°C; and oxygen saturation, 100% on room air. His mentality was alert and appeared well. No abnormalities were detected on neurological examination. No rale or wheezing was found in both lungs, and no evidence of mucosal burns or injury was found in the oral cavity and upper airway. He weighed 10.2 kg (50th percentile).

After confirming his alertness and stable vital signs, fluid therapy with nil per os was started while evaluating the manifestations of LDP poisoning. Initial venous blood gas analysis (VBGA) findings were as follows: pH, 7.34; PCO_2, 32.1 mmHg; HCO_3, 16.9 mEq/L; base excess (BE), −7.8 mEq/L; and lactate, 7.5 mmol/L. Initial laboratory findings showed a white blood cell count of 16,560/μL, hemoglobin concentration of 13.1 g/dL, and platelet count of 424,000/μL. Other laboratory findings were within normal limits.

No radiographic abnormalities were found in the initial chest radiograph and computed tomography of the chest and abdomen. However, a 2-hour follow-up VBGA showed aggravated metabolic acidosis as follows: pH, 7.25; HCO_3, 10.5 mEq/L; BE, −16.7 mEq/L; and lactate, 9.3 mmol/L. During the continuous fluid therapy, the boy gradually developed drowsiness and generalized tonic seizure from 3 hours after ingestion, and was transferred to the intensive care unit.

At the time of hospitalization, the boy's consciousness was stupor, and follow-up vital signs were as follows: blood pressure, 124/84 mmHg; heart rate, 170 beats/min; respiratory rate, 30 breaths/min; temperature, 36.4°C; and oxygen saturation, 94%. He was intubated, and subsequently underwent mechanical ventilation. A follow-up chest radiograph showed multiple lesions with ground-glass opacity and consolidation.

Massive intravenous fluid therapy was continued, and distilled water was continuously supplied via a nasogastric tube to prevent mucosal damage caused by the LDP. Intravenous antibiotics were administered due to the potential for aspiration pneumonia. Also, intravenous dexamethasone was administered to minimize secondary pneumonitis caused by the aspirated surfactant. A 6-hour follow-up VBGA showed further aggravation of acidosis with the following values: pH, 7.12; HCO_3, 14.2 mEq/L; BE, −15.2 mEq/L; and lactate, 9.0 mmol/L. Continuous renal replacement treatment (CRRT) was initiated to treat the refractory acidosis. Within 1 hour, metabolic acidosis improved. CRRT was discontinued 15 hours after the initiation. The acidosis did not worsen upon the discontinuation. Mechanical ventilation with antibiotic and steroid therapy was continued for aspiration pneumonia.

Esophagogastroduodenoscopy was performed to search for gastrointestinal damage or perforation before enteral nutrition was initiated. On day 4, mechanical ventilation was weaned given the improved mentality and respiration. A follow-up computed tomography performed on day 5 showed the atelectasis of both upper lobes. Improved consolidation was observed on a follow-up chest radiograph, and the boy was discharged uneventfully on day 13. At 1-month follow-up, he was well without symptoms and radiographic abnormalities other than residual consolidation.

Discussion

This case highlights the 2 points of LDP poisoning: first, this is easy to occur; second, more essentially, pediatricians and emergency physicians should be vigilant for the gradual onset of relevant manifestations. These manifestations include vomiting, coughing, choking, respiratory failure, changes in consciousness, damage to the gastrointestinal mucosa, and metabolic acidosis. In the present case,

the boy had been awoken at the time of presentation. However, his mentality gradually deteriorated 3 hours after the ingestion. This insidious worsening was possibly caused by metabolic acidosis. Hence, it is important to monitor the gradual changes occurring in children with LDP poisoning.

LDPs are mostly neutral or weakly alkaline, consisting of non-ionic surfactants, anionic surfactants, and propylene glycol[3]. Some pods may lead to direct caustic injury. Among the components of the pod, propylene glycol is metabolized into lactate and pyruvate *in vivo*, leading to metabolic acidosis[4]. The high concentration of product is more clinically important than the overall composition of LDP.

Ingestion is the most common route of poisoning, followed by ocular and dermal exposures[5]. Because LDPs contain a higher amount of surfactants than non-capsulated laundry detergents, tissue damage may be more severe if ingested. Vomiting incurs the aspiration that injures the pulmonary tissue. Children with LDP poisoning can develop various manifestations, including nausea, vomiting, coughing, choking, respiratory failure, altered mentality, esophageal and gastric injuries, and metabolic acidosis[2].

There are no specific detoxification methods for LDP poisoning. A U.S. National Poison Data System-based study shows dilution, irrigation, and washing as the most commonly used methods[6]. Although various methods for supportive therapy, such as intravenous dexamethasone, epinephrine, nasogastric feeding, and mechanical ventilation have been used, the standard treatment for LDP poisoning has not yet been established[1,7]. In the current case, the boy was administered distilled water via a nasogastric tube for dilution and subsequent removal of the detergent. In addition, intravenous antibiotics, dexamethasone, and mechanical ventilation were given as the treatment of aspiration pneumonia and respiratory distress. Although supportive therapy is performed in most settings, CRRT may be needed in rare cases such as this.

Considering the increasing use of LDPs in Korea, it is necessary to recognize the risk of poisoning by the pods and the gradual onset of manifestations. This recognition can result in timely treatment and prevention of poisoning.

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Conflicts of interest

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