

Toxicology

Hazard of Orbeez water-absorbent beads causing infantile small bowel obstruction: a report of two Korean cases

Eunyoung Jung¹, Sang-Hun Lee²

¹Division of Pediatric Surgery, Department of Surgery, ²Department of Emergency Medicine, Dongsan Medical Center, University of Keimyung College of Medicine, Daegu, Korea

Orbeez is a small toy made of a highly expandable, which has recently become popular in Korea. These beads can expand to 100 times or more its volume when in contact with water and can also be expected to grow in size when ingested. We encountered two pediatric patients who swallowed Orbeez and developed small bowel obstruction. In the first case, surgery was performed without knowing that the small bowel obstruction was caused by Orbeez. In the second case, based on the experience gained from the first case, a detailed history was taken, including the possibility of Orbeez ingestion to determine the cause of the small bowel obstruction. We diagnosed the cause of the small bowel obstruction early, followed by rapid treatment. We recommend that emergency department physicians must consider Orbeez as the cause of small bowel obstruction in children.

Keywords: Emergency medicine; Intestinal obstruction; Foreign bodies; Child; Laparotomy

INTRODUCTION

Foreign body ingestion is common in the emergency department (ED). The American Association of Poison Control Center reported that approximately 89,000 patients visit the hospital due to foreign body ingestion each year. Of these, more than two-thirds were children under the age of 5 years.¹ Approximately 40% of foreign substance ingestion in children is not known to the parents; thus, the actual incidence of foreign body ingestion in children may be considerably higher.² Most foreign substances are swallowed, pass through the gastrointestinal tract, and are discharged, without the need for any management. Foreign body removal is necessary in approximately 20% of patients, and cases requiring surgery are less than 1%.^{2,3} When determining how to treat the foreign body, various factors such as the clinical characteristics, size, shape, and anatomic location of the foreign body should be considered.^{2,4}

Due to the expansion of various toy markets, emergency medicine physicians often encounter new foreign bodies, such as Orbeez. Orbeez uses superabsorbent polymers. Each bead expands to more than 100 times its volume when placed in water.⁵ It is also known as “gaegulial” (meaning frog’s egg) in Korea and has become a popular toy for many Korean children. Herein, we report on two Korean infants who required emergency laparotomy because of acute small bowel obstruction caused by accidental ingestion of Orbeez.

CASE REPORT

This case report was approved by the institutional review board of Keimyung University Dongsan Hospital (no. 2021-01-078) which waived the requirement for informed consent due to the retrospective nature of this study.

책임저자: 이 상 훈

대구광역시 달서구 달구벌대로 1035

계명대학교 동산병원 응급의학과

Tel: 053-258-7895, Fax: 053-258-6305, Email: saorang7@naver.com

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Capsule Summary

What is already known in the previous study

The dangers of Orbeez ingestion are not well-known in Korea.

What is new in the current study

To the best of our knowledge, this is the first report of small bowel obstruction due to Orbeez ingestion in Korea.

1. Case 1

A 10-month-old female patient was transferred to the hospital with bilious emesis, abdominal distension, and decreased activity. She started vomiting 6 days before presenting at the hospital. She was diagnosed with functional enteritis at the local children's hospital. Symptoms worsened despite being admitted to the local hospital and starting conservative treatment. As the patient's abdominal distension was aggravated and bowel ileus findings were observed on simple abdominal radiographs, she was transferred to our ED to rule out small bowel obstruction. She showed stable vital signs other than a slightly decreased activity. Physical examination showed a soft and distended abdomen without a palpable mass or signs of peritonitis. Her white blood cell count was

4,410/ μ L, hemoglobin was 11.1 g/dL, and platelet count was 317,000/ μ L. C-reactive protein level was 1.51 mg/dL (<0.1). Simple abdominal radiography showed multiple dilated loops of the small bowel, with air-fluid level (Fig. 1). Although a round fluid-filled material was found at the junction between the dilated and collapsed small intestine on abdominal computed tomography (CT), it was difficult to definitively determine whether it was the cause of the small bowel obstruction (Fig. 2). Emergency surgery was planned to confirm the cause of the obstruction. The operation was initiated by the laparoscopic approach, but we had to convert to open laparotomy because of the large ascites and poor visualization due to the distended small bowel. A 2.5-cm jelly water bead was found at the level of the proximal ileum after enterotomy (Fig. 3). The bowel wall was focally ischemic but not necrotic. After the surgery, additional history was obtained. The infant has a 4-year-old brother who had recently played with Orbeez. From this history, we hypothesized that she had ingested the brother's Orbeez without being witnessed by anyone. The patient was discharged on postoperative day 19. The hospital stay was prolonged because of wound infection.

2. Case 2

A 16-month-old-female patient was transferred to the ED with a history of sudden onset of bilious vomiting. She had postprandial non-bilious vomiting for two days. Her

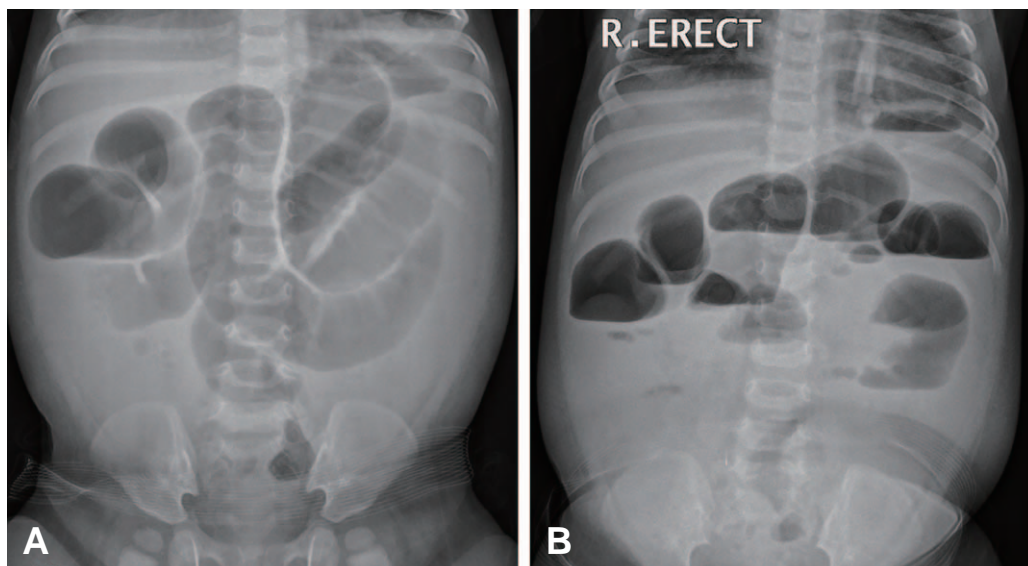


Fig. 1. Simple abdominal radiography showed multiple dilated loops of the small bowel, with air-fluid level. (A) Simple abdomen supine view. (B) Simple abdomen erect view.

vomiting became more frequent, and it changed to bilious vomiting. She has a 3-year-old sister who played with Orbeez, but her parents were not aware of any Orbeez having been ingested. Her vital signs were stable and physical examination was unremarkable. A simple abdominal radiograph showed dilated small bowel loops with air-fluid level. The patient's abdominal CT scan showed mechanical small bowel obstruction at the level of the mid-jejunum, but no suspicious foreign body was found. Emergency laparotomy was planned because Orbeez ingestion was suspected. A trans-umbilical incision was made for mini-laparotomy, and a partial fragmented Orbeez measuring 3 cm was found and removed via enterotomy. Partial enterectomy was performed as an ischemic change due to severe bowel dilatation was detected. The patient was discharged on postoperative day 6.

DISCUSSION

Orbeez is a brand selling superabsorbent polymer beads. The key constituents of the beads are acrylic acid, sodium hydroxide, and water.⁶ When in contact with water, the beads absorb the water and increase significantly in size, up to more than 100 times the original size.⁷ Recently, various complications due to Orbeez ingestion have been reported. In particular, small bowel obstruction has been reported as a common complication of ingested Orbeez in children in previous studies.⁸⁻¹⁰ Moreover, other cases have reported on Orbeez entering the airway or ear and expanding in size.^{11,12} Recently, various water bead products have been sold in Korea, and anyone can easily purchase them. Unfortunately, the dangers of Orbeez ingestion are not well known. To the

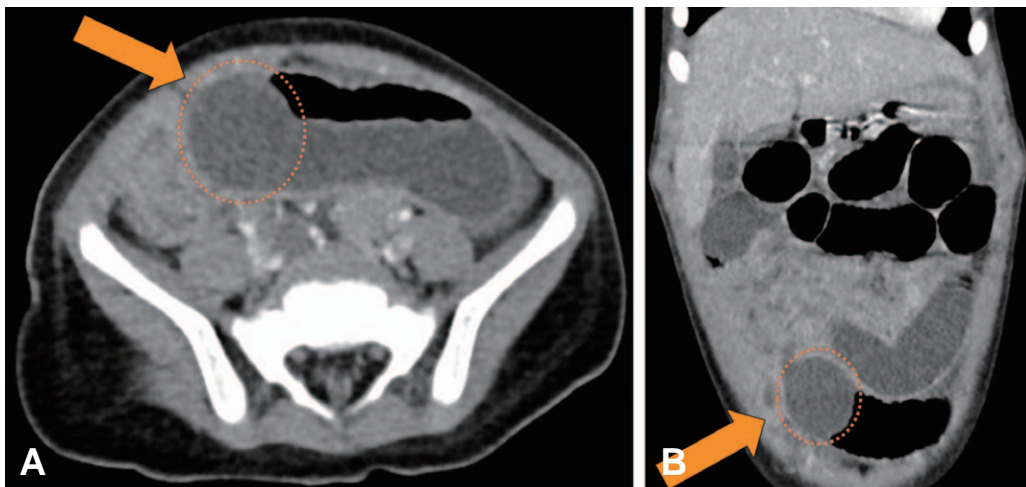


Fig. 2. A round fluid-filled material was found on abdominal computed tomography: axial view (A) and coronal view (B). Arrows indicate: suspected jelly water bead

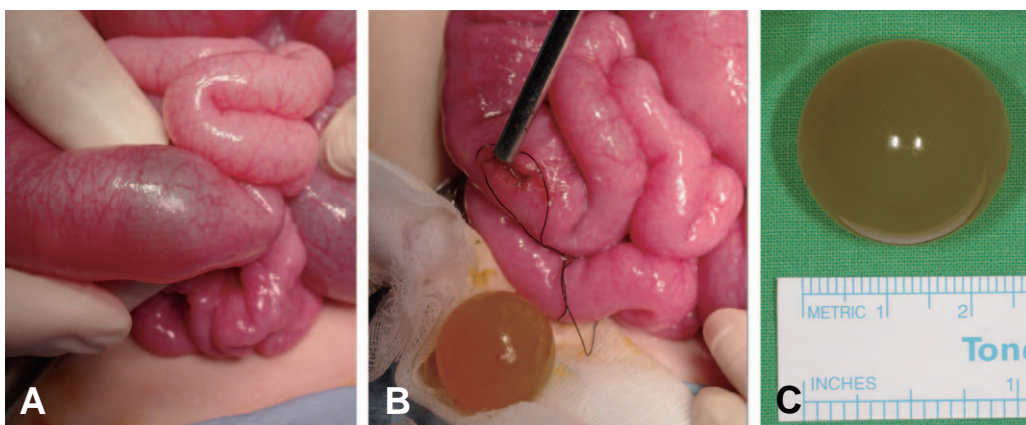


Fig. 3. (A) Found suspected to jelly water bead at the level of the proximal ileum, (B) Removed water jelly bead from the bowel. (C) Jelly water bead was measured 2.5 cm in size.

best of our knowledge, this is the first report of small bowel obstruction due to Orbeez ingestion in Korea.

One thing to be aware of when considering our two cases is that there was no problem with the children playing with Orbeez, but in both cases, the younger sibling was affected. In the first case, Orbeez was found to be the cause of the acute small bowel obstruction and surgery was indicated. In the second case, because of the experience gained from the first case and because the ED physician recognized the potential of Orbeez being the cause, it was possible to specifically ask and actively listen to the caregiver about whether the older child played with Orbeez. Recognizing the possibility of Orbeez ingestion was of great help in the diagnosis, and this resulted in prompt and timely surgical treatment for the patient.

In our cases of Orbeez ingestion, because CT signals cannot distinguish Orbeez from intestinal fluid, it was almost impossible to visually detect the ingested Orbeez in the absence of information through medical history before surgery. After surgery, the physician was able to confirm that the ingested object was Orbeez. In some cases, Orbeez ingestion was confirmed by abdominal ultrasound before surgery, but these cases seem to have been possible because the guardians witnessed the Orbeez ingestion and the physicians were informed upon taking the medical history.^{8,10}

The treatment for ingested Orbeez was surgical removal, followed by exploration through diagnostic laparoscopy and, subsequently, bowel extraction through umbilical incision expansion. In some cases, diagnostic laparotomy without laparoscopy has been performed.^{5,8,10} In one reported case, the water bead was able to be removed from the asymptomatic child via whole bowel irrigation.⁹ The surgical findings showed general bowel dilatation and focal ischemic change, and the distended bowel was friable and susceptible to damage.⁵ To manipulate the small bowel with the stretched and ischemic change, gentle careful exploration using periumbilical mini-laparotomy incision was considered more effective than laparoscopic exploration.

In children, most foreign body ingestion has a good prognosis and does not require special treatment.¹³ However, substances such as pointed or large objects, multiple foreign bodies, and mercury batteries require rapid response including examination and treatment.¹³ Many substances are detected even with simple x-rays

and can easily be tracked using CT as necessary.¹⁴ The method of removing these foreign substances is predictable and may be planned to some extent.¹⁵ Orbeez, which is different from other foreign substances, cannot be identified by medical imaging. Moreover, Orbeez is capable of expanding further. Although commercially distributed water beads such as Orbeez have a diameter of approximately 2 mm, they can expand to 100 times their original size in water.⁶ Therefore, if even one tiny bead is picked up by infants and toddlers, the bead can be easily swallowed, pass through the esophagus and stomach, and quickly enter the small intestine. The diameter of 2 mm becomes large enough to block the small intestine as the bead comes into contact with digestive juices. More seriously, Orbeez is so small that it is rarely detected by the parent or guardian, as in the two cases discussed. In the first case, the physician found the Orbeez during surgery without knowing that the patient had ingested foreign bodies. Therefore, ED physicians should be aware of the possibility of oral ingestion. Physicians must carefully consider different situations including the possibility of older siblings who play with Orbeez. Laparoscopic exploration or exploration with minimal trans-umbilical incision is recommended for whole intestinal evaluation.

In summary, the lessons learned from these two cases are as follows: (1) When obtaining history for an infant or toddler with small bowel obstruction of unknown etiology, it is essential to consider whether an older sibling may have played with Orbeez, especially when the parents or guardians are not certain if a foreign body has been ingested. (2) For manipulation of the small bowel, gentle careful exploration using a periumbilical mini-laparotomy incision is more effective than laparoscopic exploration.

ORCID

Eunyoung Jung (<https://orcid.org/0000-0002-8884-1642>)

Sang-Hun Lee (<https://orcid.org/0000-0003-4303-7375>)

CONFLICT OF INTEREST

No potential conflict of interest relevant to this article was reported.

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