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Case Report

Accidental ingestion of magnetic foreign body in a pediatric patient: A potentially fatal attraction ☆

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ABSTRACT

Foreign body ingestion is one of the most common pediatric emergencies. As part of their cognitive development, infants and toddlers are extremely curious and constantly explore their surroundings through their senses, namely taste. The ubiquity of toys containing magnetic elements consecutively meant an increase in the cases of children ingesting said magnets. While most ingested foreign bodies, including a single magnet, will spontaneously traverse the gastrointestinal tract without problems, some may give rise to grave and potentially life-threatening complications; the latter is often seen in the presence of 2 or more magnets or paramagnetic material. The diagnosis of ingestion of magnetic foreign bodies remains a challenge, given its often ambiguous history and presentation; nonetheless, their abundance, gravity, and preventability of their complications alone should render physicians vigilant and keep a low threshold of suspicion.

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Introduction

Foreign body ingestion is among the most common presenting complaints to pediatric emergency departments. Most cases seen are between the ages of 6 months and 3 years; however, there have been instances reported in children older than 3 years of age [5]. Older children may swallow such objects, particularly if suffering a behavioral or mental problem [1]. Foreign body ingestion is often benign and self-limiting; however, in the rare occasion where the ingested toys or objects con-

tain magnetic and paramagnetic elements, it may cause serious damage and complications to the gastrointestinal tract. In this report, we present the case of a child who was diagnosed on the basis of ultrasonography, after which she was promptly referred to surgery and found to have developed characteristic complications.

Presentation

A previously healthy 5-year-old female was brought to the emergency department with complaints of colicky

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Fig. 1 – Whirlpool configuration seen on ultrasound examination of the right lower quadrant – at the level of the ileum.

abdominal pain and repeated vomiting of 1-day duration. History was negative for recent illness or travel. Parents denied sick contact or ingestion of contaminated food. There was no fever or change in bowel habits. Physical examination revealed an afebrile and vitally stable child, and a soft and non-distended abdomen.

A provisional diagnosis of acute gastroenteritis was made, and the patient was sent to the radiology department for an abdominal ultrasound. Ultrasound examination revealed a whirlpool configuration of the small bowels, seen predominantly at the level of the ileal loops (Fig. 1). In addition to small amounts of free fluid and surrounding lymphadenopathy. The patient did not demonstrate any tenderness or guarding throughout the examination. Ultrasound findings prompted a plain radiographic examination of the abdomen, which had not been done prior. It revealed multiple radiopaque, adherent metallic beads surrounded by distended bowel loops (Fig. 2), which resembled the configuration seen on ultrasound. The appearance of small bowel volvulus around the foreign body raised the suspicion of it being of magnetic origin.

The patient was referred to pediatric surgery and urgently taken for laparoscopic removal of the foreign body. Intraoperative findings included distended ileal loops and adhesions resulting from the attractive magnetic forces. Four out of eleven beads were successfully retrieved laparoscopically; consequently, conversion to an open laparotomy ensued. Following the retrieval of the remaining magnetic beads, the involved bowel segments were examined. Erosive changes to the walls of the duodenum, jejunum, and mesentery were noted; in addition to a fistula formation between the duodenum and jejunum through the mesentery, and distal ileum (Fig. 3–7). The postoperative course was unremarkable.

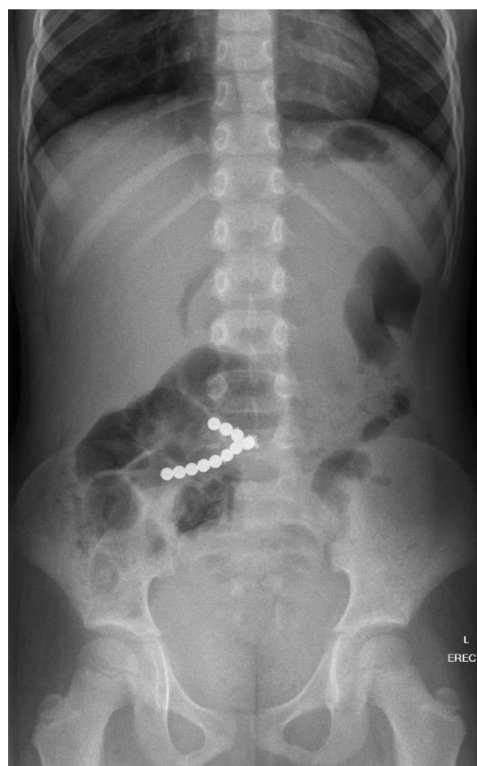


Fig. 2 – Erect abdominal radiograph revealing several spherical radiopaque objects. The surrounding bowel loops are dilated. This configuration raised suspicion of the attractive magnetic forces from either side twisting the bowels and resulting in a volvulus.

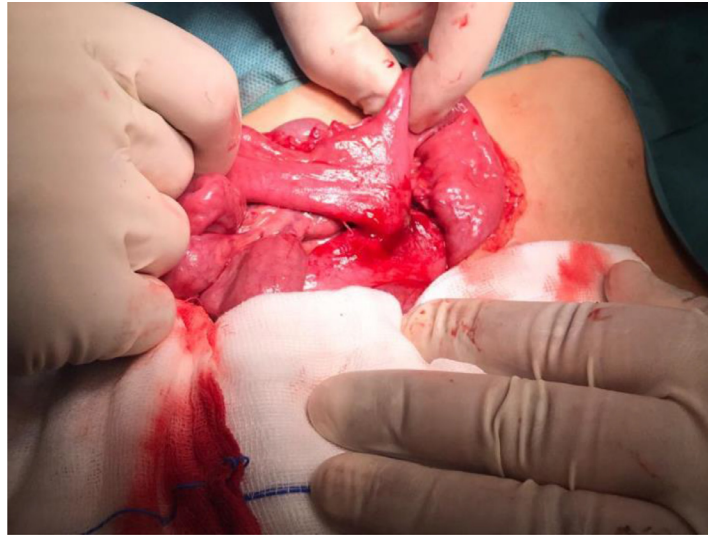


Fig. 3 – Intestinal adhesions caused by the attraction between the various segments of the magnet, visualized soon after conversion to laparotomy.

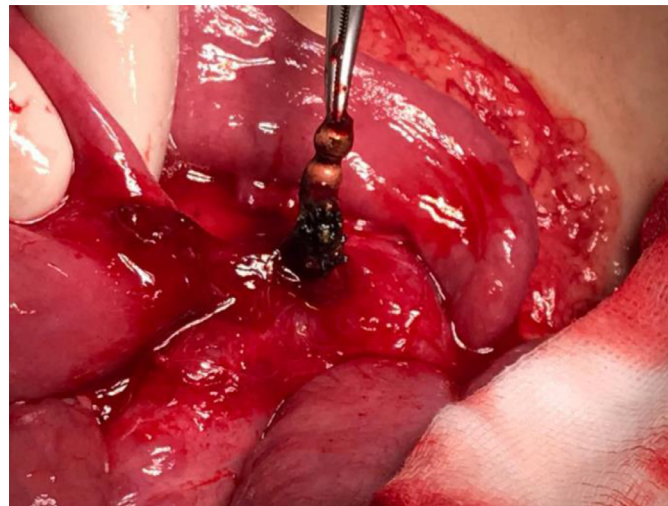


Fig. 4 – A fragment of the remaining magnetic spheres that could not be endoscopically retrieved.

Discussion

The increasing availability of toys and objects containing magnets has been paralleled with an increase in the reported cases of accidental ingestion of said magnetic objects [1][3][7]. As with most cases of foreign body ingestion, a single object containing a magnetic element may pass through the gastrointestinal tract spontaneously without causing much damage. However, due to the nature of the attractive forces between

magnets, the presence of 2 or more such objects or paramagnetic objects increases the risk of gastrointestinal complications; which may range from intestinal obstruction and ischemia to necrosis, fistula formation, and perforation [2][8][6].

Human cells contain sodium, potassium, and chloride ions, rendering it a conductor of the microscopic currents that form magnetic forces. This adhesive force acts through the gastrointestinal tract. If undetected and untreated, magnetic foreign bodies gradually erode the bowel wall, causing pressure necrosis to its mucosa and subsequent perforation. Therefore,



Fig. 5 – Erosions through the intestinal wall seen upon complete retrieval of the foreign body, creating a fistula between the duodenum (bottom left) and the jejunum (bottom right) through the mesentery (top middle).



Fig. 6 – Ileo-ileal internal fistula formed by the magnetic foreign body.

early diagnosis and treatment are of utmost importance. In some cases where a parent has witnessed a child swallowing such foreign object, or the child is old enough to state so, history is clear. While clinical presentation may be nonspecific, close attention ought to be paid to children exhibiting obstructive symptoms, such as nausea, vomiting, and abdominal pain; which in turn should prompt radiographic examination. Magnetic beads or toys often have a characteristic bond and appearance.

Due to the often negative or vague history, arrival at a diagnosis of magnetic foreign body ingestion may be delayed. However, with the increasing availability and popularity of

toys with magnetic elements, one must maintain a low index of suspicion; especially considering the serious complications that may ensue. In this particular patient, the configuration and looping of the bowel walls around characteristic beady structures strongly indicated the presence of a magnet. Owing to the length of the small bowel, it is most commonly affected by complications compared to other parts of the gastrointestinal system. This is followed by fistulas between the small bowel and colon, and stomach and jejunum [4].

Intervention may be either endoscopic, laparoscopic, or open surgical exploration. The selection of a treatment modality is guided by history, physical examination, and radiolog-



Fig. 7 – The complete foreign body containing a total of 11 spherical magnetic elements, each measuring 6 mm in diameter. One may note the difference between the configuration of the beads on the plain radiograph vs their original state; and consider the tissue impinged between the magnets.

ical investigations. In the aforementioned patient, only four out of eleven magnetic beads were successfully retrieved laparoscopically; the remaining beads were suctioned deep into the bowels, which ultimately necessitated the conversion to an open laparotomy.

Conclusion

The rising availability of magnetic toys and objects has led to an increase in the cases of ingestion of said foreign

bodies in the pediatric population. Unlike most cases of foreign body ingestion, the presence of magnetic and paramagnetic elements imposes the risk of serious injury to the gastrointestinal tract. While history and clinical presentation are often ambiguous, it is paramount that physicians carefully investigate the patient; a simple plain abdominal radiograph may suffice in revealing any dense foreign bodies of metallic densities. Moreover, parents and caregivers ought to be made aware of the risks of magnetic toys, particularly those small enough to be swallowed. Early diagnosis and management may significantly decrease and even prevent the complications and associated morbidity with magnetic foreign body ingestion.

Patient consent

Given the patient is a minor, consent for the documentation and publication of this case has been obtained from her legal guardian accompanying her at the time (father).

The information provided about this patient will maintain their anonymity and honor their privacy.

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