

Multiple magnet ingestion: Is there a role for early surgical intervention?

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Ann Saudi Med 2012; 32(1): 93-96

PMID: 22156645 DOI: 10.5144/0256-4947.2012.93

Children often swallow foreign bodies. Multiple magnet ingestion is rare, but can result in serious complications. This study presents three unique cases of multiple magnet ingestion: one case an 8-year-old boy with multiple magnet ingestion resulting in gastric obstruction and the other two cases with intestinal perforations due to multiple magnet intake. History and physical examination are unreliable in children who swallow multiple magnets. Sometimes radiological findings are not conclusive, whether one magnet is swallowed or more. If magnets are not moved in sequential radiology images, we recommend early surgical intervention before gastrointestinal complications develop. Toy companies, parents, physicians, and radiologists should be warned about the potential complications of such toys.

Foreign body ingestion is a common health problem in children, especially between the ages of 6 months and 3 years.¹ Magnet ingestion, though rare, can bring about serious problems. Magnets are widely used as pieces of toys, which are favored both by manufacturers and children. Despite warnings about the hazards of such toys, there is still a lack of knowledge among health care providers, parents, and even physicians.^{2,3} Multiple magnet ingestion can cause severe abdominal morbidities, such as small-bowel perforation, fistula formation, intestinal volvulus, and even death.¹⁻⁸ This study presents a case of multiple magnet ingestion with consequent gastric obstruction requiring surgery. Two other cases of peritonitis due to swallowing multiple magnets are described. All three patients were admitted to the emergency department of a children's medical center in 2008.

CASE 1

An 8-year-old boy was brought to the emergency department after his mother had noticed him putting a magnetic toy bar (a piece of a magnetic building toy) into his mouth. The child stated, "Someone ordered me to eat several pieces of my toy." Other than mild abdominal discomfort, the child had not developed any symptoms by then. A plain radiograph of the abdomen showed several bar-shaped and round metallic

objects attached to each other in the stomach, and a round one far away in the intestine. The objects presented a unique view inside the stomach (**Figure 1**). An emergent laparotomy was performed, which revealed several magnets attached to each other inside the stomach. Thirty-five magnetic toy bars, 22 tiny cylinder-shaped magnets, and 12 ball bearings (sphere shaped) were removed (**Figure 2**). The solitary ball bearing passed through the gastrointestinal tract. The child was discharged on postoperative day 7 after a full recovery.

CASE 2

A 3-year-old girl with complaints of mild abdominal discomfort and nausea was treated for gastroenteritis in a private clinic. After 3 days, the abdominal pain recurred, which aggravated within hours. She presented to the emergency department. An abdominal exam revealed guarding and generalized tenderness. An abdominal radiograph showed two foreign bodies of metallic origin attached to each other in the lower abdomen. An emergent laparotomy showed two attached small magnetic objects in the jejunum and two similar ones attached in the cecum (**Figure 3**). They had attracted one another leading to compression of bowel walls, pressure necrosis, and perforation of the jejunum and cecum. The objects were removed and the

perforations oversewn. The child was discharged on postoperative day 6 after an uneventful recovery.

CASE 3

A 7-year-old boy was referred to the emergency department with complaints of sudden-onset abdominal pain and nausea. The plain radiograph showed two oval-shaped metallic objects attached to each other in the right lower quadrant of abdomen (**Figure 4**). An emergent laparotomy revealed two similar magnetic toys (6 mm in diameter and 24 mm in length) attached to each other through bowel walls, resulting in intestinal perforations. The objects were removed and

the perforations repaired. The patient was discharged after full recovery.

DISCUSSION

This study reports three unique cases of multiple magnet ingestion, which is very rare in the region. When a solitary magnet is ingested, it usually poses no problem, but multiple magnet ingestion could be harmful; and, rarely, deadly. Ingested magnets (two or more) can become aligned and can attract one another through multiple bowel walls. Furthermore, this leads to compression of the intestinal wall, pressure necrosis, intestinal perforation, fistula formation, and other gastrointestinal morbidities.^{2,4-7} In 2006, the US Center for Disease Control reported 20 cases of multiple magnet ingestion that resulted in gastrointestinal complications.⁴ Fifteen of these patients developed bowel perforation and peritonitis, while three patients presented with volvulus; 1 of them, a 20-month-old boy, died as a result of bowel perforation and severe sepsis. The boy had ingested 9 building-toy magnets. Although infants and toddlers are more prone to ingest small objects, magnet ingestion is reported in children of older ages and also in adults. Reportedly, multiple magnet intake is more common in children with psychological conditions such as autism,

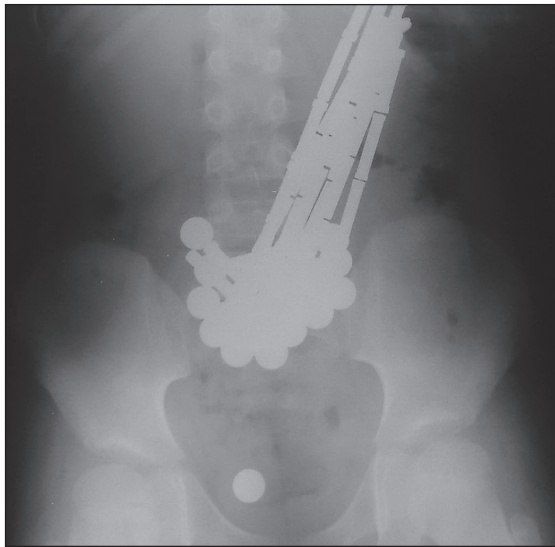


Figure 1. A plain abdominal radiograph shows several bar-shaped and sphere-shaped magnets attached to each other. Together they mimic the shape of the stomach. One solitary magnet is seen far away in the intestine.



Figure 2. The same patient (Figure 1); multiple bar toys, ball bearings and tiny magnets were removed.



Figure 3. An intraoperative image indicates intestinal perforations caused by pressure necrosis of attached magnets.



Figure 4. A plain abdominal radiograph shows two magnets attracted each other in the intestinal loops that provided a unique view.

attention-deficit/hyperactivity disorder, and psychosis.² One of the patients in our study, an 8-year-old boy, reported “being ordered to swallow multiple objects.” A history of magnet ingestion is usually lacking. Only in the first case of this study did the parents give a history of magnet ingestion; however, the mother became aware only after her child had ingested more than 40 magnets. In the other two subjects, the parents gave no give any history of magnet intake. Sometimes primary symptoms are so mild that children are treated in an outpatient clinical setting, like the second patient of this study, who was treated for gastroenteritis. Recently in a review of 128 cases of multiple magnet ingestion, Oestreich reported that because of the vague symptoms, there is considerable delay in seeking proper medical attention. This study emphasizes the need for education of health care providers, child-care nurses, and parents, and suggest an instructive role for manufacturers of toys, in preventing magnet-ingestion-caused hazards.² Manufacturers of toys should warn parents about the potential hazardous consequences of swallowing magnets used in toys. The use of such haz-

ardous toys should be restricted, especially for children with psychological problems. In several studies, plain radiographs have been the first imaging modality for visualizing magnets. In some cases, magnets were discovered in computed tomography or sonography.² In this study, the diagnosis was made based on plain radiographs. In the first case, the plain radiograph showed plenty of differently shaped magnets stacked together in the stomach, making a ladder-form view. Since it was impossible and dangerous to retrieve them via endoscopy, laparotomy was performed to remove them. In the second and third cases, the plain radiographs showed multiple metallic objects that along with the signs of peritonitis demanded emergent laparotomy. Plain radiographs could be misleading, especially when there is no reliable and accurate history about the number of magnets swallowed. One technique is to enlarge the relevant portion of the image to detect the multiplicity of the magnets.⁸ One study reported a case of a 3-year-old boy with a complaint of abdominal pain. The primary abdominal radiograph showed a solitary rod-shaped metal object. After proper instructions, he was sent home. He returned 3 days later with the presentation of acute abdomen. The laparotomy that revealed a solitary metallic object was in fact of a cluster of 5 small magnets attached to each other. The authors suggested that the algorithm for managing magnet ingestion be revised. They proposed that close observation is imperative, even if there is presumably one magnet swallowed; and surgical intervention is necessary when the first signs of obstruction or increasing abdominal pain are present.⁵ Ilce et al suggested immediate laparotomy, once multiple magnet ingestion is strongly suspected.⁷ Another study stated that a revision in the algorithm of managing multiple magnets ingestion is obligatory; the investigators in the study stressed that because of the potential for serious complications, surgical intervention is mandatory when the magnets have passed further than the stomach and are not retrievable by means of endoscopy.⁶ Altogether, this study suggests close observation when history and imaging findings are not convincing for the number of magnets swallowed. Our study also suggests performing sequential abdominal radiographs. If the objects (or seemingly a solitary one) have not moved in sequential radiology images, the study recommends early surgical intervention before complications occur. However, health care providers, physicians, and radiologists should be aware of the probability of occurrence of this problem and its serious complications.

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