

# The Rise of Magnet Toys Causing Rise of Abdominal Explorations: A Case Series

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The incidence of magnet ingestion is increasing in emergency cases. A patient with magnet ingestion can be symptomatic or asymptomatic. If symptomatic and coupled with multiple ingestions, the situation requires a thorough workup and retrieval. We herein report a series of 5 cases that presented with multiple magnet ingestions and eventually had to undergo abdominal exploration for retrieval. All of them initially had basic lab work, followed by radiological imaging, and after the initial resuscitation, parental counseling, and consent underwent exploration.

Children, as they are getting on their feet, have an urge to put everything in their mouths. Physicians all over the world have dealt with the ingestion of foreign bodies, but awareness needs to be spread about magnetic foreign bodies as they can cause serious complications.<sup>1</sup> A single magnet acts just like other foreign bodies and is usually passed without any problem; however, more than 1 magnet can cause serious problems. Due to their nature of attracting each other and this nature of magnets can cause the gut wall to be trapped between them leading to ischemia, perforation, fistula formation, etc.<sup>2</sup> Magnets come in different shapes and sizes, mostly as toys, and are usually portrayed as educational helpers, stress relievers, or simple blocks and building sets. They are easily available, and although their boxes may show age restrictions, they are still commonly bought for all age groups. The most dangerous among them are "High-Powered" or "Rare Earth" magnets, which are so strong that they should be thrown out of the house. Children can accidentally ingest them, which can be fatal. Magnet ingestion has been reported for a long time now, with the earliest dating back to 1992. Herein, we report 5 cases of patients who had to go through the stress of exploration just because of naive mischief.

## CASE 1

A 6-year-old boy presented in the emergency room with a history of ingesting 5 magnets 4 days ago as confirmed by the mother. The patient had complaints of non-bilious, non-projectile vomiting over the last 2 days and abdominal pain for 1 day. The patient was initially taken to a local clinic where he was advised to eat bananas and stool bulk-forming agents before being sent home, but the were concerned and brought patient to us in a tertiary care center. On presentation, the patient was afebrile and vitally stable, and on examination abdomen was soft, non-tender, and no distension. Abdominal radio-graph showed 5 spherical magnets adjacent to the L3 vertebrae forming a string of pearls (Figure 1A). Following baseline investigations, a decision was made to explore the patient.

A right upper transverse incision was made and the abdomen was opened in layers. The intestines were exteriorized and inspected, and a small perforation of 1 × 2 cm in the jejunal wall was seen, which was 10 cm from the duodenojejunal flexure. Luckily, 3 of the magnets were found here. An attempt was then made to find the other 2 magnets, and despite inspecting the whole gut, they couldn't be found. A fluoroscope was then used

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Received: May 28, 2024

Revision Requested: June 4, 2024

Last Revision Received: June 23, 2024

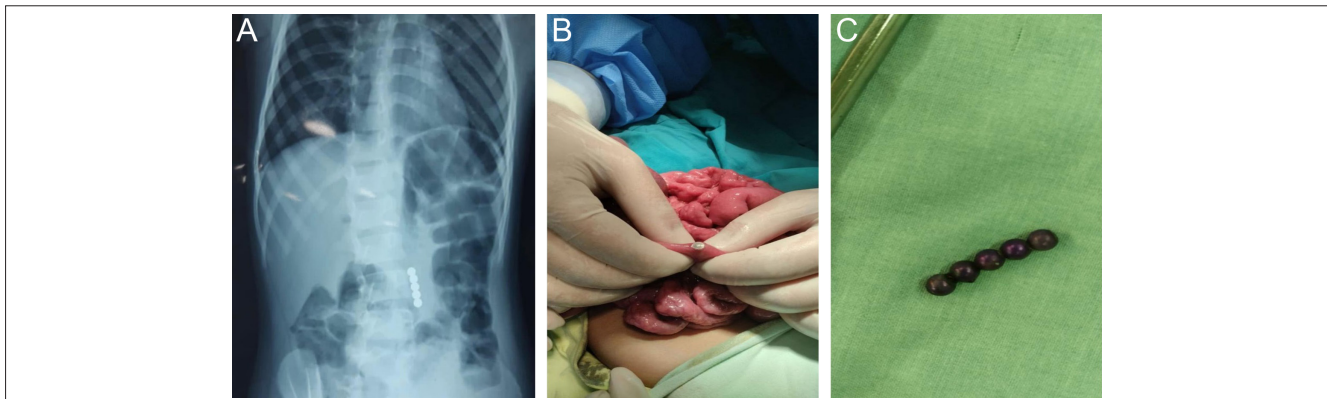
Accepted: June 24, 2024

Publication Date: September 23, 2024

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**Cite this article as:** Ahmed M, Memon H, Habib M, Raza Ahmad R, Amjad Chaudhary M. The rise of magnet toys causing rise of abdominal explorations: A Case Series. *Turk Arch Pediatr.* 2024;59(6):595-598.



**Figure 1.** (A) Abdominal x-ray shows 5 magnets, (B) 1 × 2 cm perforation in the jejunum, (C) retrieved magnets.

to localize the other 2 magnets, and they were seen in the stomach. They were milked down all the way to the jejunum and retrieved from the site of the perforation (Figure 1B). The retrieved magnets can be seen (Figure 1C). The perforation was repaired using fine absorbable sutures, and a nasogastric tube was placed.

Postoperatively, the patient was put on intravenous antibiotics and analgesics, and this period remained uneventful. The patient was started orally on third postoperative day and was discharged on the fifth postoperative day with instructions for follow-up.

### CASE 2

A 7-year-old boy presented in the emergency with a history of 3 magnets while playing, witnessed by his sister, following which he had complaints of abdominal pain and also complained of non-bilious vomiting.

On presentation, the patient was vitally stable with a normal abdominal examination.

Abdominal X-ray was advised which showed 3 spherical magnets in the left lumbar region (Figure 2A). Following parental counseling and consent, patient was taken to the OR.

Peri-operatively, 2 cylindrical magnets were felt in the second part of the duodenum, and 1 spherical observed in the stomach (Figure 2B). All the magnets were milked down to the ileum,

an enterotomy was performed, and magnets were removed (Figure 2C). Luckily, the patient survived the perforation. The postoperative period was uneventful. Oral intake was started on third postoperative day, and patient was discharged on the fourth postoperative day.

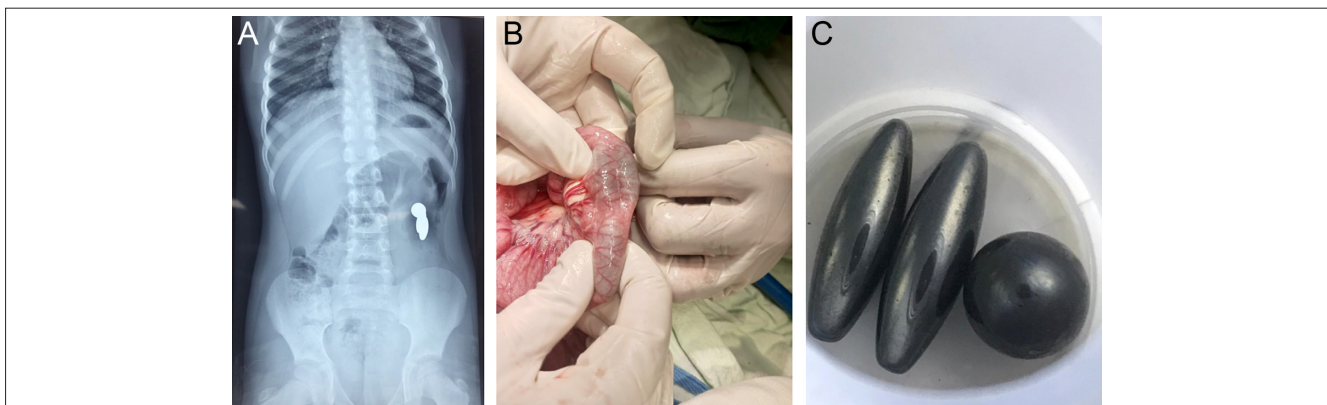
### CASE 3

A 3-year-old boy presented in the emergency with complaints of abdominal pain and vomiting following the ingestion of 3 magnets, 3 days ago. On examination, the patient was vitally stable with guarding in epigastrium, abdomen was soft. The rest of the examination was unremarkable.

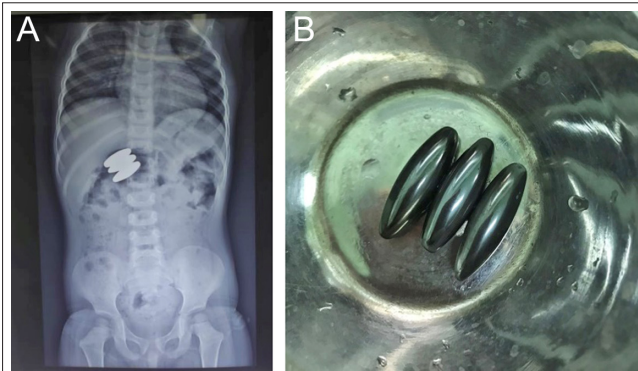
Patient was admitted and resuscitation was started; meanwhile, labs and X-ray obtained, which showed 3 spherical magnets adjacent to stomach (Figure 3A), parental counselling was done and consent was obtained, and patient was shifted to the OR.

Peri-operatively, all 3 magnets were observed to be in the second part of the duodenum. They were all milked down to the rectum and were removed per rectally (Figure 3B). An erythematous patch was observed in the jejunum about 1 feet from DJ flexure, and Lambert sutures were placed over it. An on-table, x-ray was obtained, which was clear.

Postoperative period was unremarkable, and the patient was allowed orally on the second postoperative day and discharged on the third postoperative day.



**Figure 2.** (A) Abdominal radiograph showing magnets, (B) magnets visible in the gut wall, (C) retrieved magnets.



**Figure 3.** (A) Magnets ingested by a 3-year-old depicted in an abdominal radiograph, (B) retrieved magnets.

#### CASE 4

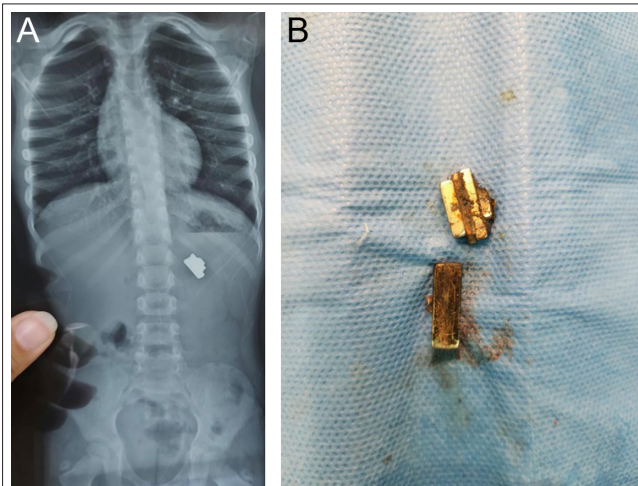
A 4-year-old male child presented in the emergency department with a history of magnets ingestion 3 days ago, witnessed by the mother. His initial complaints were abdominal pain and vomiting.

On examination, the abdomen was soft, tender at the epigastrium, and non distended. The vitals were within normal limits. An X-ray abdomen was ordered, which showed radio-opaque object in stomach (Figure 4A).

Patient was prepared for surgery and, following initial resuscitation, was taken to the OR.

Perioperative findings were about 1 × 1 cm perforation in the lesser curvature of the stomach through which magnets were observed poking out. Magnets were retrieved from the perforation, and a total of 5 magnets were found (Figure 4B). A gastrotomy was performed and repaired with an omental patch.

Postoperatively, the patient remained stable with oral intake starting on the fourth postoperative day and discharge on the fifth postoperative day.



**Figure 4.** (A) Abdominal radiograph showing magnets, (B) retrieved magnets.

#### CASE 5

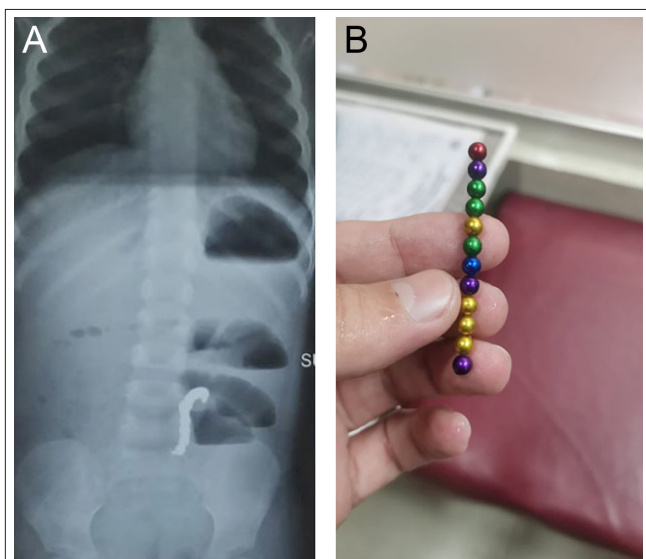
A 2.5-year-old baby girl presented in the emergency department with complaints of bilious vomiting and abdominal pain abdomen from last 2 days.

On examination, the patient was stable vitally. The abdomen was soft, with generalized tenderness and mildly distended. There was no history of foreign body ingestion. Following initial resuscitation, a hematological workup was sent, and X-ray abdomen was obtained, which showed air-fluid levels along with radio-opaque small spherical objects clustered together (Figure 5A). The patient was planned for exploration.

On exploration, 12 small magnets clustered together were retrieved from the ileum (Figure 5B), 3 perforations were also observed which were primarily repaired, and the patient was shifted to the ward. Postoperatively, the patient remained stable, and on third postoperative day, oral started and the patient discharged on the fifth postoperative day. All the characteristics are shown in Table 1.

Foreign body ingestion is relatively common in the pediatric population and often overlooked. Patients usually present with non-specific symptoms, such as vomiting, abdominal pain, and sometimes no symptoms at all.<sup>3</sup> But a history of abdominal pain coupled with magnet ingestion warrants thorough investigation. The earliest reported case of complications caused by magnets was in 1995, and following that, we have seen a surge in cases without any break, which will continue to grow if it's not handled timely.<sup>4</sup>

Neodymium magnets have a property of forming a strong magnetic field and attracting other magnet. The complication they cause in the intestines occurs when 2 or more magnets are ingested together or with breaks. They exhibit their magnetic field properties in the intestines too, attracting toward one another and damaging whatever comes between which can lead to ischemia, necrosis, perforation, and fistula.<sup>5,6</sup>



**Figure 5.** (A) Multiple small magnets ingested by the patient, (B) magnets seen following exploration.



**Table 1.** Summary of Case Series of Magnet Ingestion in Pediatric Patients

Case No	Age	Gender	Symptoms	History	Mode of Presentation	Magnet Location	Perforation	Removed Via
1	6 Years	M	Vomiting+pain abdomen	4 days	Emergency	Jejunum	Yes	Enterotomy
2	7 Years	M	Vomiting+pain adomen	1 day	Emergency	Second part of Duodenum	No	Enterotomy
3	3 Years	M	Vomiting	3 days	Emergency	Second part of duodenum	No	Milking to Rectum
4	4 Years	M	Vomiting	3 days	Emergency	Stomach	Yes	Perforation
5	2.5 Years	F	Vomiting+pain abdomen	Unwitnessed	Emergency	Ileum	Yes	Perforation

The main hurdle for the physicians is that patients remain asymptomatic at the start, and if there is no witness to ingestion of magnets, treatment can be delayed.<sup>7</sup>

A patient with a history of magnet ingestion must undergo an abdominal radiograph as an initial non-invasive investigation.<sup>8</sup> Depending upon the findings, a single magnet with the patient tolerating oral intake can be treated as an outpatient. However, if the patient has ingested multiple magnets and is experiencing abdominal pain, surgical intervention is warranted. This is because there is a risk that the magnets will link and anchor to each other across loops of bowel, causing a perforation.<sup>9</sup> As seen in our cases, the magnets had a characteristic bead-of-pearls appearance on the abdominal radiograph. Once confirmed, the magnets should be removed surgically. An underlying perforation is imminent, as some of our patients had experienced.

Traditionally, patients were prescribed stool bulk formers, and objects are usually excreted through the gastrointestinal tract if they have crossed the stomach. But since the advent of modern imaging techniques, emergency medical physicians have become more vigilant about magnet ingestion.<sup>10</sup> As with increased in frequency and presentations in the emergency room. It needs a thorough workup.

Like any other foreign body, you cannot wait for magnets to pass spontaneously. In the meanwhile, they can erode the bowel wall, hence causing perforation.<sup>11,12</sup> Though a single magnet might pass uneventfully, strict monitoring should be placed in toy shops for age-related toys and to keep people aware of the dangerous consequences of playing with multiple magnets. Information needs to be spread in the case of magnets, which are becoming as dangerous as bullets, leading to explorations, deteriorations, and even in some cases death.<sup>13</sup> Parental teaching is necessary in this regard; they must be informed about the devastating effects small magnets can cause.

Magnet ingestion in the pediatric population is common. All patients with multiple magnet ingestions, symptomatic or asymptomatic, should be kept under observation and thoroughly investigated. Regulatory changes, health care provider awareness, and parent education about magnet safety are important components in mitigating the risks of magnet ingestion.

**Informed Consent:** Written informed consent was obtained from the patient's legal guardians for the publication of this case report and any accompanying images.

**Peer-review:** Externally peer-reviewed.

**Author Contributions:** Concept – M.A.; Design – H.M.; Supervision – M.A.C.; Resources – M.H., H.M.; Materials – R.R., M.H.; Data Collection and/or Processing – M.A.; Analysis and/or Interpretation – H.M.; Literature Search – R.R.; Writing – M.A.; Critical Review – M.A.C.

**Declaration of Interests:** The authors have no conflicts of interest to declare.

**Funding:** This study received no funding.

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**Data Availability Statement:** The data that support the findings of this study are available from the corresponding author upon request.