

## An intra-abdominal triangular magnetic reconstruction

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### Abstract

Magnet ingestions present an increasing problem in pediatric surgery. Especially multiple magnets in the digestive tract pose a significant health hazard and cause severe complications. We report a 6-year-old boy presenting with mild abdominal symptoms after ingesting eleven magnetic parts of a construction toy set about three weeks before. The radiography revealed an extraordinary intra-abdominal triangular reconstruction. Only gastroscopy following open surgery succeeded in the retrieval of all magnetic parts. A magnet in the stomach reconnected with one in the jejunum, causing necrosis of the intestinal wall on both sides. Radiography is the diagnostic tool of choice for magnet ingestions but does not always solve all questions immediately, and different approaches to remove the magnets are often necessary.

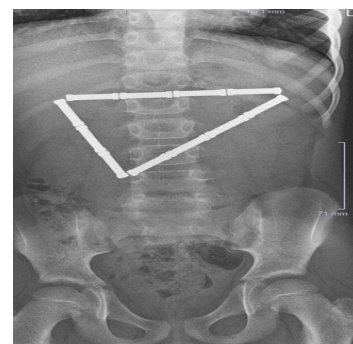
**Keywords:** Foreign body ingestion; magnets; perforation; foreign body retrieval.

### Introduction

One of the critical concerns in pediatric surgery is the ingestion of foreign bodies (FBI), especially if they are magnetic or consist of metal with conductive or (ferro)magnetic properties. FBI is most common in older babies and toddlers between 6 months and three years [1] but has a second peak in children up to 12 years in age, with a median age of 7.9 years [2]. While even a single battery is prone to damaging the mucosa of the digestive system due to its conducting nature, magnets unfold their dangerous nature when ingested at least in pairs [3]. However, the number of magnets swallowed ranges widely in case reports and reviews. The problem lies in the capacity of their intra-abdominal recombination, which can lead directly to obstruction of passage or pinch part of the GI system by trapping the intestinal wall between the magnets, resulting in necrosis, perforations, fistulas and even fatal outcomes [4]. In many cases, a conservative strategy is successful after the foreign body passes the oesophagus and is then spontaneously excreted. Half of the patients, including magnets or magnetic and magnetisable metallic objects, require surgical intervention like laparotomy, endoscopy, or even both [5, 6].

### Case Report

We report on a 6-year-old boy presenting at the pediatric outpatient clinic complaining of abdominal pain, followed by



**Figure 1:** X-ray of the abdomen in anteroposterior view.

nausea without vomiting, established on this day with new severity but generally persisting in mild form over the last three weeks. His parents were suspicious that he swallowed parts of his building toy set containing plastic rods interconnected with magnet joints around the same time. He reported episodes of mild symptoms over this period but never showed signs of food withdrawal or irregular bowel movements. The X-ray of the abdomen in anteroposterior view (**Figure 1**) showed a total of eleven magnetic elements, each measuring 3 centimetres in length and around 0.7 centimetres in diameter. Together they mounted in an isosceles triangle ranging over the whole upper abdomen, covering parts of the stomach and duodenum up to the proximal jejunum. There were no recog-

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nisable signs of free air or direct organ damage. The patient was admitted and scheduled for surgery.

Initially, a gastroscopy was performed. A total of four magnets were retrieved from the stomach. However, the triangle disconnected, and the remaining magnets dislodged post-pyloric and got out of reach. Additionally, the edge of the triangle had perforated the back wall of the stomach at the level of the greater curvature. Therefore, an open procedure via median longitudinal upper abdominal laparotomy was carried out. The counter-perforation was found in the jejunum (**Figure 2**). After expanding the site of damage, the remaining three and four magnets were evacuated. Both puncture sites were stitched over. The postoperative course was uneventful, and the patient was discharged on postoperative day eight.



**Figure 2:** Intraoperative view of the wall of the stomach (top) and jejunum (bottom) showing the area of intestinal impingement.

## Discussion

Magnetic toys are trendy, correlating with a rising number of ingestion incidents, especially of high-risk injuries caused by multiple, smaller magnets [7]. Nowadays used neodymium magnets are more potent than traditional ferrite magnets. They tend to be very small and, therefore, are easy to swallow [7]. An asymptomatic period of several weeks and even months is not unusual: Sola et al. reported that just 39% of patients with one or more ingested magnets develop symptoms at all [2]. In our case, the ingestion caused slight abdominal pain and mild nausea for several weeks until the symptoms increased, and the family sought medical help for the first time. A significant problem is the by parents often unnoticed intake of foreign bodies. The symptoms are also very unspecific and do not immediately indicate a complication from ingesting a foreign body. Abdominal pain and vomiting are reported as the most common complaints. These symptoms support many differential diagnoses and can, therefore, complicate and delay diagnosis and therapy of magnet ingestions [2].

The guidelines for multiple magnet ingestions by the *North American Society for Pediatric Gastroenterology, Hepatology and Nutrition* (NASPGHAN) recommend starting with accurate history. Then the number of ingested magnets needs to be determined, which can be done by abdominal X-ray [8]. NASPGHAN and the *European Society for Paediatric Gastroenterology, Hepatology and Nutrition* (ESPGHAN), together with **the European Society of Gastrointestinal Endoscopy** (ESGE), therefore, always suggest a biplane radiograph, if and only if a

magnet-like object was found in the first plane [4, 9]. Multiple radiologic views can be necessary because magnets can stick together, overlap on a single view, and be misdiagnosed as a single magnet [4, 5].

Overall, it is prudent to remove the magnets endoscopically if possible [4]. If the magnets are not accessible through endoscopy, NASPGHAN recommends close monitoring through a series of X-rays every 4-6 hours. A single magnet can be treated with a laxative to aid passage. European guidelines share the view on the subject, especially recommend urgent (less than 24 hours) removal of all magnets within endoscopic reach. For those beyond endoscopic reach, close observation is advised [8]. We chose the open approach after the initial trial by gastroscopy over the laparoscopic procedure. In our opinion, the magnetic toy parts' magnitude, shape and unknown interconnectivity behaviour were disproportional to the size of the trocar incisions and the risk of losing parts in the abdominal cavity. Case reports or reviews favour and adhere mostly to one of the techniques but yield no in-depth discussion for a reason for their choosing [2, 5, 6]. Unlike the recommendations, we did not perform serial radiography as we had an affirmed period of at least three weeks without progression. We didn't expect a wait-and-watch strategy to resolve the given magnetic construct.

## Conclusion

An extraordinary geometric shape was discovered intra-abdominally on radiography in the reported case. It was caused by the ingestion of eleven toy magnets, resulting in a complete internal geometric rebuilding and perforations of the stomach and jejunum. Magnetic toys are widely used, while producers and parents partly ignore the potential dangers.

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**Conflict of interest:** The authors declare that they have no conflict of interest.

**Patient consent:** Written informed consent for publication was obtained by the parents.

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