



Case report

A case report of multiple foreign body ingestion with a ring-like configuration: The magnetic effect

Takwa Mili^{*}, Awatef Charieg, Yosra Ben Ahmed, Maryem Marzouki, Faouzi Nouira, Said Jlidi

Department of Pediatric Surgery "B", Bechir Hamza Children's Hospital, Tunis, Tunisia

ARTICLE INFO

Keywords:

Foreign bodies
Magnets
Surgery
Pediatrics
Case report

ABSTRACT

Introduction: Magnetic foreign body (FB) ingestion represents a significant health hazard among children. The increasing use of small attractive magnets as toys or parts of various household accessories makes it easily accessible to children. The aim of this report is to raise awareness of public authorities and parents around exposing children to magnetic toys.

Case presentation: We report a case of multiple FB ingestion in a 3-year-old child. Radiological imaging revealed multiple round objects arranged in a circular shape resembling a ring. Surgical exploration showed multiple intestinal perforations attributed to the magnetic attraction between the objects.

Clinical discussion: Although more than 99 % of ingested FB pass without surgical intervention, ingestion of multiple magnetic FB provides a substantially higher risk of injury due to self-association and therefore requires a more aggressive clinical approach. A stable or clinically benign condition, though common, does not necessarily mean a safe situation in the abdomen. Literature review suggests that emergency surgical intervention should be pursued to avoid potentially life-threatening complications; perforation and peritonitis.

Conclusion: Multiple magnet ingestion is rare, but can result in serious complications. We recommend early surgical intervention before gastrointestinal complications develop.

1. Introduction

Foreign body (FB) ingestion is a common clinical problem in children, especially those under the age of five. Most ingested objects pass through the gastrointestinal tract spontaneously without causing any harm. However, FB ingestion can cause bowel obstruction, perforation, or bleeding [1]. Magnetic FB is of particular concern because of their unique properties. The attractive force between magnets can cause them to stick together across the bowel wall, leading to tissue damage and perforation. The aim of this report is to raise awareness of public authorities and parents around exposing children to magnetic toys.

This manuscript was prepared in accordance with the SCARE 2020 guidelines [2].

2. Presentation of case

A previously healthy 3-year-old female presented for abdominal pain. Her mother suspected that the child may have ingested magnet beads one day before presentation. On arrival, the child was

comfortable, vital parameters and abdominal examinations were normal.

Abdominal radiograph revealed multiple radio-opaque FB attached in a configuration that looked like a complete ring. We counted 23 individual spherical magnets held together (Fig. 1).

Despite the child was clinically well, we decided to perform surgical exploration on the same day for concern of enteric perforation. Laparoscopic attempt to locate and extract the FB was unsuccessful. Therefore, we performed laparotomy. The magnets were found to be attracted to each other, causing them to stick together across the bowel wall and leading to tissue damage and perforation. Three areas of full thickness erosions were noted: 1 in the posterior wall of distal duodenum and two in the proximal jejunum, 10 cm beyond the duodenojejunal flexure. Five intestinal perforations were identified: 2 in the proximal jejunum and 3 in the terminal ileum. There was no obvious peritoneal contamination. The openings in the intestines were enlarged and 23 magnetic beads adhering to each other were extracted. We resected 6 cm of small bowel and performed two end-to-end anastomoses. The areas of erosions were identified meticulously. We performed primary repair with interrupted

^{*} Corresponding author.

E-mail address: mili.takwa@hotmail.com (T. Mili).

<https://doi.org/10.1016/j.ijscr.2023.108177>

Received 20 March 2023; Received in revised form 31 March 2023; Accepted 31 March 2023

Available online 11 April 2023

2210-2612/© 2023 The Authors. Published by Elsevier Ltd on behalf of IJS Publishing Group Ltd. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).



Fig. 1. Abdominal radiograph with “ring-like” radio-opaque structure and the corresponding removed magnets.

absorbable sutures in a single layer (Fig. 2).

Postoperative radiograph showed no retained magnetic beads. Recovery was uneventful. The patient tolerated diet by the 5th day and was discharged on the seventh postoperative day. She was well at 2-month follow-up (Fig. 3).

3. Discussion

Foreign objects in the gastrointestinal tract most frequently are encountered in young children. The presence of large number of colorful magnets in the children's toys started to appear in the recent years. Similar cases were reported in the literature.

Although more than 99 % of ingested FB pass without surgical intervention, ingestion of multiple magnetic FB provides a substantially higher risk of injury due to self-association and therefore requires a more aggressive clinical approach [3].

Patients may be completely asymptomatic; however, if intestinal complications have occurred (usually between 1 and 7 days after ingestion [4]), they may present abdominal pain, vomiting, hematemesis, peritonitis and life-threatening condition.

Abdominal X-ray confirms the diagnosis. As exemplified in this case, it is possible for ingested magnets to form familiar shapes, such as rings, and to masquerade as one FB.

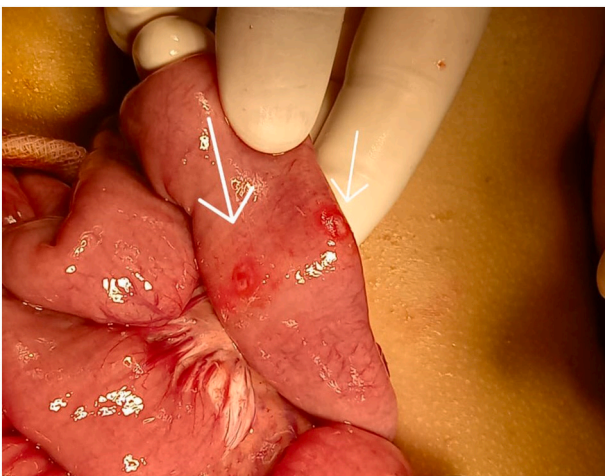


Fig. 2. Intraoperative photography: the arrow indicates intestinal erosions caused by pressure necrosis of attached magnets.

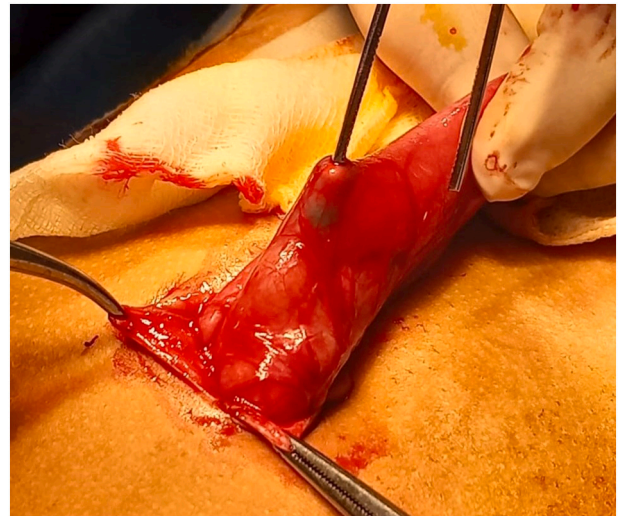


Fig. 3. Magnetic sphere ingested attached to the metallic instrument.

If a watchful waiting would be the appropriate management for a single magnet ingestion [1], multiple magnets ingestion requires surgery. A stable or clinically benign condition, though common, does not necessarily mean a safe situation in the abdomen. Literature review suggests that emergency surgical intervention should be pursued to avoid potentially life-threatening complications; perforation and peritonitis [4–7]. It can be performed laparoscopically or through an open approach, depending on clinical data of the patient and operator's experience. Endoscopic approach can be used to extract gastric single located magnets [8]. However, surgery is needed when endoscopic management failed.

A systematic review of gastrointestinal injury caused by magnetic FB ingestions in children and adolescents found most children were younger than 6 years. Magnetic FBs ingested were mainly toys. The number of FBs ranged from 2 to 100. Majority of patients were previously healthy [9]. Diagnosis and treatment were often delayed. On surgery, intestinal damage was the most common injury. Most patients require bowel resection or fistula repair.

Artificial intelligence (AI) and machine learning (ML) can be useful tools in surgery, particularly in the areas of image analysis and surgical planning [10]. In the case of magnet ingestion, AI and ML algorithms could be trained on large datasets of patient records, imaging studies, and surgical outcomes to identify patterns and correlations that could aid in decision-making. However, further research is needed to validate the accuracy and reliability of these systems before they can be widely adopted in clinical practice.

Through this case, we aimed to protect children from magnet ingestion. We recommend abolishing small magnet parts in toys.

4. Conclusion

Most ingested foreign bodies pass spontaneously. However, the ingestion of multiple magnets presents a unique situation in which foreign objects are not able to pass with normal motility due to tethering between loops of bowel, which may become ischemic and perforate. We recommend early surgical intervention before gastrointestinal complications develop. Toy companies, parents and physicians should be warned of potentially fatal outcome of ingesting these ‘nice-looking’ toys.

Parental consent for minors

Written informed consent was obtained from the patient's parents/legal guardian for publication of this case report and accompanying

images. A copy of the written consent is available for review by the Editor-in-Chief of this journal on request.

Ethical approval

Ethical approval was provided by the authors' institution.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author contribution

T Mili: conception, data acquisition, manuscript writing, literature review.

A. Charieg: editing and critical revision of the article.

Y. Ben Ahmed and M. Marzouki: data analysis.

S Jlidi: review and final approval.

Guarantor

Dr. Takwa Mili.

Research registration number

Not applicable.

Declaration of competing interest

No conflicts of interests to declare.

References

- [1] M.S. Mostafa, A.A. Darwish, Magnet ingestion in children and its implications: tertiary Centre experience, *Pediatr. Surg. Int.* 37 (7) (2021) 937–944.
- [2] R.A. Agha, T. Franchi, C. Sohrabi, G. Mathew, A. Kerwan, A. Thoma, et al., The SCARE 2020 guideline: updating consensus surgical CAse REport (SCARE) guidelines, *Int. J. Surg.* 1 (84) (2020 Dec) 226–230.
- [3] J. Savage, T. Clarnette, S.K. King, Toy magnet ingestion and small bowel obstruction: a lesson for both paediatricians and surgeons, *J. Paediatr. Child Health* 49 (9) (2013) E461–E462.
- [4] Y. Kim, J. Hong, S.B. Moon, Ingestion of multiple magnets: the count does matter, *J. Pediatr. Surg. Case Rep.* 2 (3) (2014) 130–132.
- [5] M. Honzumi, C. Shigemori, H. Ito, Y. Mohri, H. Urata, T. Yamamoto, An intestinal fistula in a 3-year-old child caused by the ingestion of magnets: report of a case, *Surg. Today* 25 (6) (1995) 552–553.
- [6] A. Nui, T. Hirama, T. Katsuramaki, T. Maeda, M. Meguro, M. Nagayama, et al., An intestinal volvulus caused by multiple magnet ingestion: an unexpected risk in children, *J. Pediatr. Surg.* 40 (9) (2005) e9–e11.
- [7] H. Taher, A. Azzam, O. Khowailed, M. Elseoudi, M. Shaban, G. Eltagy, A case report of an asymptomatic male child with multiple entero-enteric fistulae post multiple magnet ingestion, *Int. J. Surg. Case Rep.* 58 (2019) 50–53.
- [8] A.M. Waters, D.H. Teitelbaum, V. Thorne, A. Bousvaros, R.A. Noel, E.A. Beierle, Surgical management and morbidity of pediatric magnet ingestions, *J. Surg. Res.* 199 (1) (2015) 137–140.
- [9] Liu S. Qi, P. Lei, Y. Lv, Wang S. Pei, Yan X. Peng, Ma H. Jun, et al., Systematic review of gastrointestinal injury caused by magnetic foreign body ingestions in children and adolescence, *Chin. J. Gastrointest. Surg.* 14 (10) (2011) 756–761.
- [10] H. Taher, V. Grasso, S. Tawfik, A. Gumbs, The challenges of deep learning in artificial intelligence and autonomous actions in surgery: a literature review, *Art. Int. Surg.* 2 (2022) 144–158, <https://doi.org/10.20517/ais.2022.11>.