

# Laparoscopic Diagnosis of Magnetic Malrotation with Fistula and Volvulus

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## ABSTRACT

**Introduction:** Most foreign bodies that a child ingests pass harmlessly through the gastrointestinal tract. However, ingesting multiple magnets places a child at risk for serious viscus injury.

**Case Description:** A 16-y-old boy swallowed multiple magnets and presented with abdominal pain and emesis. Upon laparoscopy, the boy was found to have malrotation with volvulus caused by a cecal magnet attracted to a gastric magnet, resulting in a gastrocecal fistula.

**Discussion:** We review the management of magnet ingestion with an emphasis on a high index of suspicion and the use of laparoscopy for diagnosis, as well as the consequences of a coexisting rotational anomaly.

**Key Words:** Magnets, Foreign bodies, Intestinal volvulus, Malrotation, Laparoscopy, Adolescent.

## INTRODUCTION

Ingestion of magnets is rare, but ingested magnets have been reported as an often overlooked and dangerous entity in children. When removed from toys and other household items, magnets are small and easily swallowed. Although many other ingested objects can be managed expectantly, magnets can cause pressure necrosis and intestinal perforation, if not managed expeditiously. The purpose of this report is to demonstrate the use of laparoscopy to diagnose a gastrocecal fistula, which could not be definitively demonstrated on imaging.

## CASE REPORT

A 16-y-old developmentally delayed boy presented to the emergency department because of a right lower quadrant pain and emesis at home. He had reported swallowing several magnets 2 d before. The child remembered swallowing a total of 3 magnets over the course of 1 h to become more “attractive” to young women. The recently purchased magnets had been advertised on packaging as the world’s strongest magnets. Two hours before presentation, the boy had bile-tinged emesis and developed mild right lower quadrant pain without other symptoms. Physical examination was unremarkable, except for mild right lower quadrant tenderness. A plain X-ray demonstrated an apparent single metallic foreign body in the left upper quadrant (**Figure 1**). The white blood cell count was elevated to 16K, but remaining laboratory values were normal. Because of clinical concern, given the history of multiple magnet ingestion, even with only very mild symptoms, the patient was taken to the operating room.

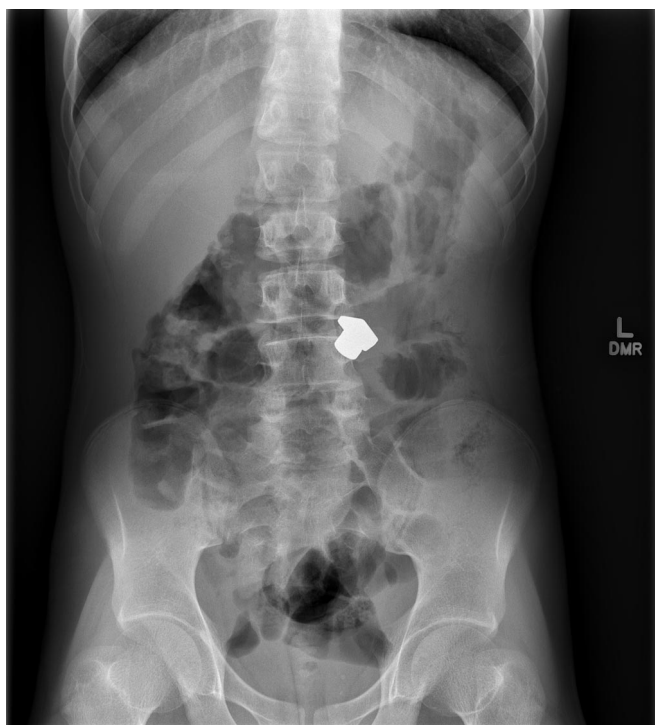
Diagnostic laparoscopy was performed, and this revealed diffusely dilated, but viable, small bowel loops. With the addition of fluoroscopy and as a result of the strong attraction of the magnets to the laparoscopic instruments, the area of interest was identified (**Figure 2**). The magnets were indeed found to be in different portions of the bowel, strongly adherent to each other, with a very thinned-out intervening bowel (**Figure 3**). There was no evidence of peritoneal contamination. It was determined that the magnet in the cecum was firmly adherent to a magnet in the stomach, causing an impending gastrocecal fistula. At this point, a laparotomy was performed. This revealed that the patient also had malrotation with incomplete rotation of the cecum and large bowel, which were loose and intraperito-

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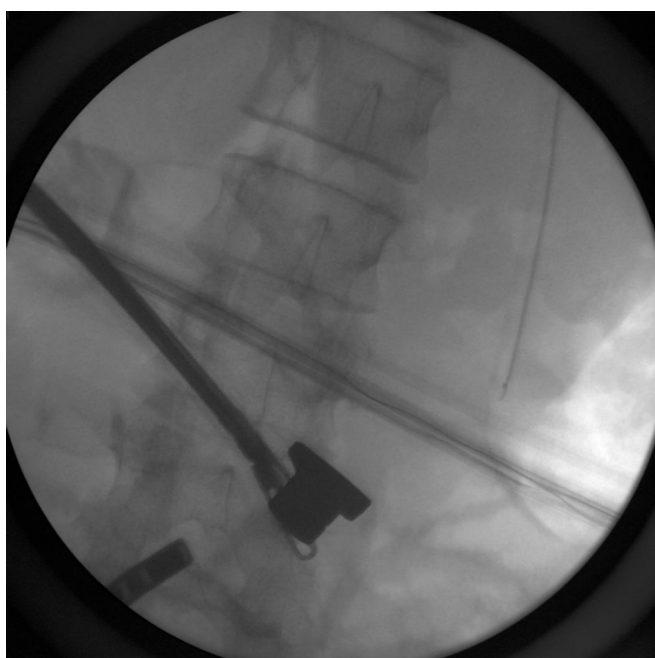
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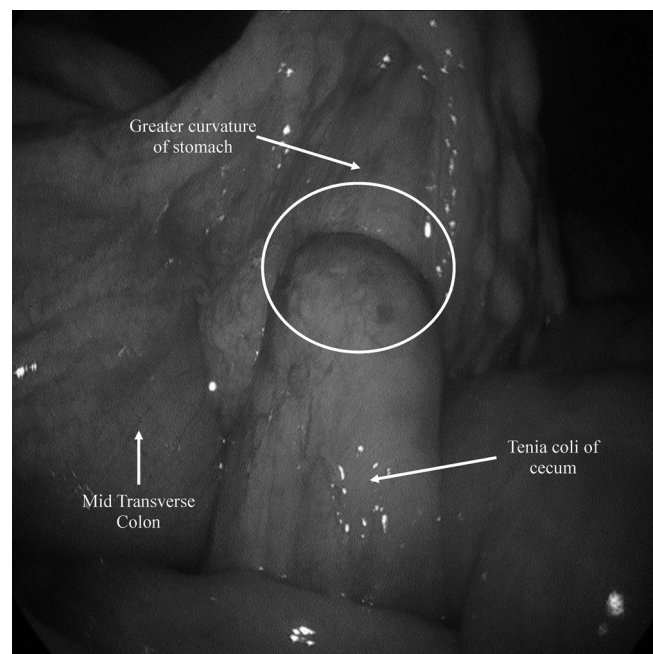


**Figure 1.** Abdominal radiograph demonstrating a metallic foreign body.



**Figure 2.** Intraoperative fluoroscopy demonstrating adherence of grasper to luminal foreign body.

neal, and a lax duodenojejunal junction with a redundant duodenum that was near midline, resulting in a narrow mesentery. This configuration allowed the magnet in the cecum (with the ascending colon) to wrap counterclockwise around the base of the small bowel mesentery and stick to the magnet in the greater curvature of the stomach, causing a volvulus. A stapling device was used to perform a wedge resection of the involved greater curvature of the stomach and antimesenteric wall of the



**Figure 3.** Laparoscopic examination demonstrating a magnet in the cecum adherent to a magnet in the stomach (circle).



**Figure 4.** Gross inspection of the 3 ingested foreign bodies and resected gastric wall.

cecum (**Figure 4**). With the cecum released from the stomach, the volvulus was able to be reduced. In addition, a Ladd's procedure was performed. Examination of the entire small bowel also revealed a Meckel's diverticulum with abnormal tissue at its tip, and a stapled diverticulectomy was performed. Pathology confirmed full-thickness necrosis of involved viscus likely in the process of forming a fistula as well as ectopic gastric tissue within the Meckel's diverticulum.

The boy tolerated the procedure well and was transferred to the intensive care unit for monitoring. After several days of nasogastric suction and bowel rest, the patient had return of bowel function, was discharged home on postoperative day 8, and has been recovering uneventfully at home.

## DISCUSSION

Foreign body ingestion in children is a common reason for emergency department visits, but most pass spontaneously through the gastrointestinal (GI) tract without intervention. However, magnets pose a unique challenge because, unlike other foreign objects, when several are ingested, with or without other metal objects they create an underestimated danger. Several recent reports have described complications such as pressure necrosis of the involved tissues resulting from the attraction of the magnets across separate areas of the bowel, GI fistula formation, obstruction, perforation, and volvulus of the involved organs, even resulting in death.<sup>1-4</sup> As a result, the old paradigm of conservative management in foreign body ingestion is being revised.

A magnet ingestion may be treated less aggressively if the magnet is not swallowed in tandem with other magnets or metallic items. Unfortunately, the clinical examination may be misleading, and diagnostic images may only be helpful in identification of multiple metallic foreign bodies, rather than their precise location within the lumen (or lumens) of the GI tract. Although initial management was conservative as with other swallowed foreign bodies, recent reports recommend more stringent indications for operative intervention, including the first signs of any obstruction or worsening abdominal pain and any patient in whom multiple magnets have been ingested.<sup>5,6</sup> Earlier intervention is recommended to reduce morbidity, and a separate algorithm for ingested magnets is likely warranted.<sup>2</sup> Some have even advocated the use of these properties of magnets to form an anastomosis of the GI tract.<sup>7</sup>

Laparoscopy has been previously described for diagnosis and treatment associated with complications from foreign body ingestion, such as entrapment within the appendix and a foreign body within the colon causing an irreducible her-

nia,<sup>8,9</sup> and also recently with a case of magnet ingestion.<sup>2</sup> In cases of multiple magnet ingestion, our case also illustrates the benefit of laparoscopy to determine hollow viscus injury and to guide treatment in such cases. One previous report does show that rotational anomalies provide added concern in cases of foreign body ingestion, as in our case.<sup>10</sup>

## CONCLUSION

This report demonstrates that despite a benign physical examination and the radiographic appearance of magnets stuck together in one location, laparoscopy allowed diagnosis of the first reported case of multiple magnets causing a small bowel volvulus resulting from a preexisting rotational anomaly. We strongly recommend laparoscopy for any child with multiple magnet ingestion in cases where the magnets could be in separate portions of a hollow viscus, because imaging can be unreliable. Coexistent malrotation can cause life-threatening complications that can be averted with early diagnosis.

## References:

1. Butterworth J, Feltis B. Toy magnet ingestion in children: revising the algorithm. *J Pediatr Surg.* 2007;42:e3-5.
2. Dutta S, Barzin A. Multiple magnet ingestion as a source of severe gastrointestinal complications requiring surgical interventions. *Arch Pediatr Adolesc Med.* 2008;162:123-125.
3. Oestreich AE. Worldwide survey of damage from swallowing multiple magnets. *Pediatr Radiol.* 2009;39:142-147.
4. Hernández Anselmi E, Gutiérrez San Roman C, Barrios Fontoba JE, et al. Intestinal perforation caused by magnetic toys. *J Pediatr Surg.* 2007;42:e13-16.
5. Moussouras N, Pratt CA, Neilson I. Magnetic toy ingestion: surgical implications. *Alaska Med.* 2008;49:117-119.
6. Jamshidi R, Hamson M. A stronger understanding of magnet ingestion injuries. *Arch Pediatr Adolesc Med.* 2008;162:900.
7. Jamshidi R, Stephenson JT, Clay JG, Pichakron KO, Harrison MR. Magnamosis: magnetic compression anastomosis with comparison to suture and staple techniques. *J Pediatr Surg.* 2009;44:222-228.
8. Hartin CW, Lau ST, Caty MG. Metallic foreign body in the appendix of a 3-year-old boy. *J Pediatr Surg.* 2008;43:2106-2108.
9. Hartin CW, Caty MG, Bass KD. Laparoscopy for perforated Richter hernia with incarcerated foreign body. *J Pediatr Surg.* 2011;46:1449-1451.
10. de la Fuente SG, Rice HE. Ingestion of unusual foreign bodies and malrotation: a "perfect storm." *Pediatr Surg Int.* 2006;22:869-872.