

## Case Report

# Successful Endoscopic Removal of 42 Magnetic Balls

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### ABSTRACT

Foreign body ingestion in pediatric patients is a common emergency department presentation. Despite a ban and recall in 2014 for the magnetic toy “Buckyballs” due to posing a deadly risk if ingested, clinical cases continue to occur. The need for surgical management in the setting of multiple magnet ingestions is related to compromised blood supply when at least two magnets are attracted while separated by gastrointestinal mucosa, and previous studies have indicated that the majority of multiple magnet ingestions require surgical intervention. In the setting of a known recent ingestion, endoscopic removal can potentially safely avoid the morbidity and mortality associated with surgical procedures. We present an interesting clinical case of multiple magnetic ingestion managed with endoscopic procedure.

**KEYWORDS:** Buckyballs, endoscopy, foreign body, fullerenes, magnet

## INTRODUCTION

Foreign body ingestion is a common presentation for pediatric emergency rooms, often requiring gastroenterology or surgical involvement for removal. Although magnets constitute a low number of these ingestions, they have a significantly higher rate of morbidity and mortality.<sup>[1]</sup> The children's toy known as “Buckyballs” is spherical fullerene molecules with  $C^{60}$  formula made of 20 hexagons and 12 pentagons with a carbon atom at each vertex.<sup>[2]</sup> These and similar rare earth metals have been made into magnetic children's toys and are 5–10 times stronger than traditional magnets.<sup>[2]</sup> Ingestion of these toy magnetic balls has been associated with serious gastrointestinal (GI) injuries requiring emergent surgical interventions such as laparoscopy or laparotomy, GI perforation, fistula formation, and death in some cases.<sup>[1–4]</sup> Reviews of studies that discuss multiple magnet ingestions have reported successful endoscopic removal of up to ingestion of 27 magnets. Here, we describe successful endoscopic removal following ingestion of 42 magnets, avoiding hospitalization and the morbidity associated with surgical intervention.

## CASE REPORT

A 3-year-old male patient presented to our Emergency Department within 1 h following concern for ingestion

of magnetic balls. Although the ingestion was not witnessed, the mother observed him playing with the toy and that multiple magnets were missing. On arrival to the emergency department, he was asymptomatic by history and clinical examination. Abdominal radiographic imaging showed 42 linked magnetic balls initiating in the stomach and terminating in the fourth portion of the duodenum [Figure 1]. The appearance was concerning for the final magnetic ball in the duodenum being magnetically attracted to a magnet that was located in the stomach, potentially compromising the blood supply in these areas. After discussion with the surgical team, it was decided to initially attempt endoscopic removal but to switch to a surgical intervention if unsuccessful or if concerns for acute abdomen noted during the procedure. We performed an emergent endoscopy 2.9 h after initial presentation to our facility with the pediatric surgery on standby under general anesthesia with cuffed endotracheal intubation. Upper endoscopy (Olympus GIF-H190 9.2 mm) was performed to visualize any mucosal injury in the esophagus, stomach, and duodenum, and also to appreciate the chain of ingested magnetic balls [Figure 2]. Subsequently, rat tooth alligator forceps

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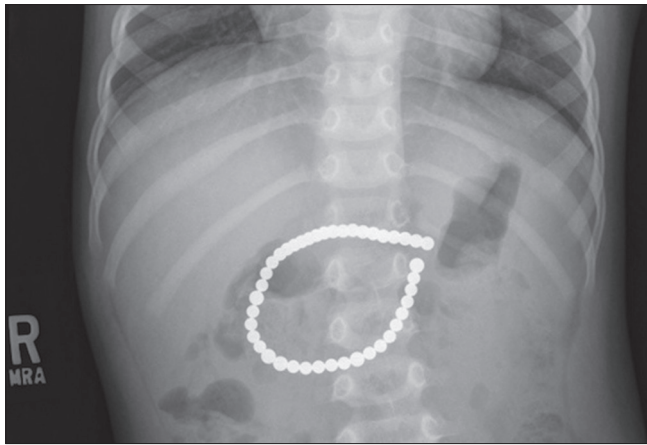
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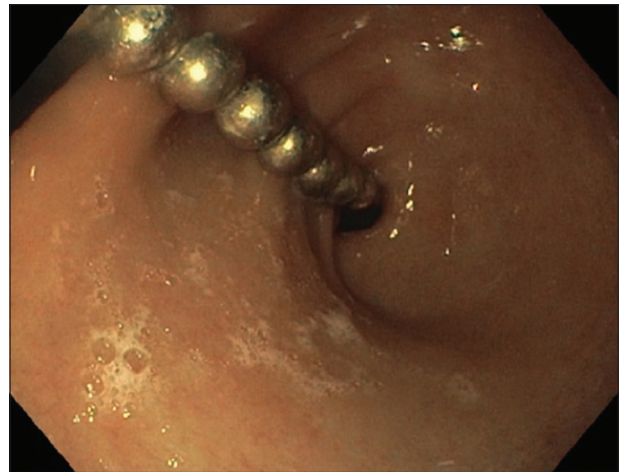


**Figure 1:** Abdominal x-ray imaging showing 42 metallic rounded magnets in the distal stomach extending to the 4th segment of the duodenum

(Olympus FG-44NR-1) were used to successfully detach the attracted magnets in the stomach from the magnets in the duodenum, and pull a continuous chain of magnets free from the upper GI tract without any mucosal injury in the duodenum, stomach, and esophagus. The magnets located in the stomach provided a magnetic attraction to the material comprising the forceps materials. The magnetism allowed enough of a firm grasp on the circular object to disrupt the gastric-duodenal magnetic attraction. Intraoperative radiological imaging confirmed that all magnets were successfully removed with no evidence of abdominal free air to suggest perforation. The patient awoke from anesthesia with no complications and was discharged home after 2 h of observation following appropriate safety counseling. The patient's mother canceled a 4-week follow-up clinical appointment as the patient recovered well and remained asymptomatic.

## DISCUSSION

Despite being recalled and banned from the market in 2014 by The United States Consumer and Product Safety Commission,<sup>[5]</sup> Buckyballs and similar products continue to pose a danger through households that had purchased the toy before withdrawal from retail stores or online sales. Pediatric emergency departments, jointly with surgical and gastroenterology teams, would benefit from having a protocol in place to rapidly triage these patients, allowing them to be directed to procedural intervention as quickly as possible. Several factors served in the success of this patient's outcome and avoidance of surgical intervention. These included early awareness of possible ingestion and presentation to the emergency department by the patient's family, presence of the magnets in the



**Figure 2:** Intra-operative endoscopic imaging showing chain of magnetic balls in the stomach, extending out of the pylorus and into the duodenum

stomach, and quick turnaround time from diagnosis by radiographic imaging to beginning endoscopic procedure. We feel that in the setting of gastric containing magnetic foreign bodies known to be acutely ingested, attempting endoscopic removal in an operating room with surgical team on standby is indicated to avoid morbidity and mortality associated with surgery. However, given the high risk of perforation and fistula formation following multiple magnet ingestions, this is a decision that must be made jointly and with the awareness of the surgical team based on the patient's clinical presentation.

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## Conflicts of interest

There are no conflicts of interest.

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