CASE REPORT

Swallowed magnets and batteries: a dangerous but not unexpected attraction

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SUMMARY

An 18-month-old boy was witnessed swallowing a cluster of five magnetic toy balls. He was coincidentally noted on plain x-rays to have also recently swallowed a watch battery and a small screw. Initial outpatient management with serial review and x-rays was unsuccessful, and delayed inpatient surgical care by 9 days. Although the child never manifested features of systemic or gastrointestinal upset, emergency laparotomy confirmed a resultant jejunocolic fistula. This case demonstrates how clinical assessment of children who have swallowed magnets separately from each other can be falsely reassuring, and highlights the potential dangers of outpatient management. We recommend children who have swallowed separately >1 magnetic objects (or >1 objects capable of magnetic attraction) be managed as inpatients with active observation and timely foreign body removal.

BACKGROUND

The incidence of magnetic foreign body (FB) ingestion by children is increasing, most likely owing to the growing popularity of magnetic toys. This is a cause for particular concern as children who swallow multiple magnets are at particular risk of abdominal complications.

CASE PRESENTATION

An 18-month-old boy was witnessed swallowing a cluster of five magnetised toy balls. His parents brought him immediately to a district general hospital, where primary assessment showed him to be well and plain abdominal x-ray confirmed a string of five ball shaped FBs overlying the gastric bubble. Strikingly, however, the abdominal x-ray demonstrated two *additional* FBs: a button battery in the left upper quadrant and a small screw shaped FB in the right lower quadrant (figure 1A). Although there was no history as to when these

additional unexpected FBs had been swallowed, their position on imaging beyond the stomach indicates they had been swallowed on a separate and previous occasion.

INVESTIGATIONS

Serial plain x-rays were obtained, the results and interpretation of which are discussed elsewhere (figure 1; see *Case Presentation* and *Treatment*). Haematological and biochemical investigations were normal on the day of laparotomy, including a white cell count of 8.4 (normal $6-17.5 \times 10^9/l$) and C reactive protein of <1 mg/l (normal <10 mg/l).

TREATMENT

At the time of primary presentation the regional paediatric surgical service was contacted for advice. Having confirmed the boy's unremarkable clinical status and reviewed the radiology, the paediatric surgical team advised management as an outpatient with reassessment and repeat abdominal x-ray in 48 h. At this later time, the patient remained free from symptoms and signs of gastrointestinal or systemic upset. Repeat x-ray showed the cluster of five magnetised toy balls to be opposed to the button battery in the left upper quadrant, and the aforementioned screw-shaped FB to be in a static position (figure 1B). The regional paediatric surgical service was contacted again, and the advice regarding management was unchanged, albeit reassessment and repeat x-ray was scheduled for 1 week hence.

A week later, the boy was reassessed and reimaged as planned. The parents had no concerns regarding the child's well being. The clinical assessment remained unremarkable, with no focal abdominal tenderness, peritonism, or signs of intestinal obstruction or sepsis. x-Ray findings were essentially unchanged from that previous (figure 1C), except the screw-shaped FB was now absent. On this third occasion, 9 days after initial presentation, the receiving paediatric surgical team appreciated the potential gravity of the situation and requested the infant be transferred to the regional paediatric centre for further inpatient treatment.

In light of the suspected enteroenteral fistulation, operative intervention was planned with a combined endoscopic and open surgical approach. Colonoscopy was undertaken but no FB or fistula was demonstrated, despite excellent views. Laparotomy confirmed the presence of a jejunocolic fistula, and pleasingly there was no peritoneal soiling or pus (figure 2A). The jejunocolic fistula was then disrupted and the strongly opposed FBs

Figure 1 Plain abdominal x-rays (A) on the day of primary presentation, (B) 2 days and (C) 9 days postprimary presentation. Dotted circles highlight radio-opaque foreign bodies.

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Figure 2 (A) Jejunocolic fistula, (B) removal of foreign body via disrupted fistula, (C) magnetised button battery and magnetic toy balls.

were removed (figure 2B,C). A limited jejunal resection with anastomosis was performed, and the colon repaired primarily.

OUTCOME AND FOLLOW-UP

The child was discharged home on the fifth postoperative day. He was confirmed to have had recovered without further complication when reviewed 3 months postsurgery.

DISCUSSION

Swallowed FBs are a common cause for paediatric presentation to both primary care and hospital settings. Where primary assessment shows the FB has passed into the stomach or beyond, the vast majority of children require no further treatment. Indeed FBs including button batteries, alkaline batteries, pins and single magnetic objects pass from the stomach safely and without delay in the vast majority of cases.^{1–3} However, conservative outpatient management is not advised for children who have swallowed *multiple and separate* magnetic FBs (or multiple FBs capable of magnetic attraction) owing to increased risks of abdominal complications, including intestinal ulceration, perforation, fistulation, adhesions, intussusception, peritonitis, volvulus, sepsis and even death.^{4–8}

The incidence of cases and complications of multiple ingested magnets, attributed primarily to an increased use of magnets in toys, is increasing. This has prompted increasingly vocal warnings in medical and other forms of press regarding the dangers for children who have swallowed multiple magnetic FBs.^{8–10} The nuance that these dangers are mirrored in children who have swallowed a single magnet as well as other FBs capable of magnetic attraction has not been overlooked in the literature.^{11 12} However, this case highlights the ease with which this may be overlooked in practice.

There are three key lessons (or *expectations*) arising from this case, which inform the management of multiple, non-oesophageal, magnetic swallowed FBs. First, separately ingested FBs capable of magnetic attraction can be *expected* to attract and ultimately appose one another through the walls of separate bowel loops. Indeed, the dependable nature of ingested magnetic FBs to attract has formed the basis for therapeutic trials, for example, magnetic compression bowel anastomoses (magnamosis).¹³

Second, failure of conservative management with complications can be *expected* owing to opposition of magnetic attracted FBs through the walls of separate bowel loops, resulting in injury, entrapment, or twisting of bowel loops.^{5–8 10} This risk is often further increased by diagnostic and therapeutic delay.^{5 8} Therefore, we recommend children who have swallowed multiple and separate FBs capable of magnetic attraction to be admitted as inpatients, even if an initial trial of non-operative management with active observation is planned.

Third, clinical assessment of children with complications owing to swallowing magnetic FBs may be *expected* to underscore both the complexity and severity of resultant abdominal complications.^{5–8} Thus, lack of the usual clinical triggers for

decision-making may falsely embolden unsuspecting, ‘*unexpected*’ healthcare professionals to defer necessary care. This is not to discount the value of a thorough clinical assessment, which may indeed correctly identify features of acute intra-abdominal pathology. Rather we seek to affirm the importance of positive findings, while cautioning the emphasis placed on negative findings, during the assessment of these children.

There is little consensus regarding the timing and manner of FB removal in the setting of *multiple and separate* magnetic FBs (or FBs capable of magnetic attraction). Given the complexity of presentation and outcome in these cases, we like others advocate prompt and proactive management, with a low threshold for FB removal.^{6–8 11} Endoscopic, laparoscopic or open approaches have all found favour in the literature.^{5 7 8} However, the varied nature of presentation and complication of multiple magnetic FB ingestion makes dogmatic statements of one approach’s superiority over another ill-placed. Therefore, decisions regarding the manner of FB(s) removal should be tailored to the individual case, as well as the expertise of the surgeons or other medical practitioners involved.

Learning points

- ▶ Children who ingest multiple magnetic objects are at increased risk of complications.
- ▶ Separately ingested magnets can be expected to attract each other through separate bowel walls, and so cause complications such as intestinal fistulae or obstruction.
- ▶ Inpatient treatment with a low threshold for magnetic object removal is necessary to prevent and mitigate complications.
- ▶ The clinical assessment of children with complications owing to multiple magnetic object ingestion may be falsely reassuring.
- ▶ Endoscopic, laparoscopic and open approaches each have a selected role in the timely removal of ingested magnetic objects.

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