

Multiple Neodymium Magnet Ingestion Causing Multisegment Bowel Entrapment in a Toddler: A Case Report

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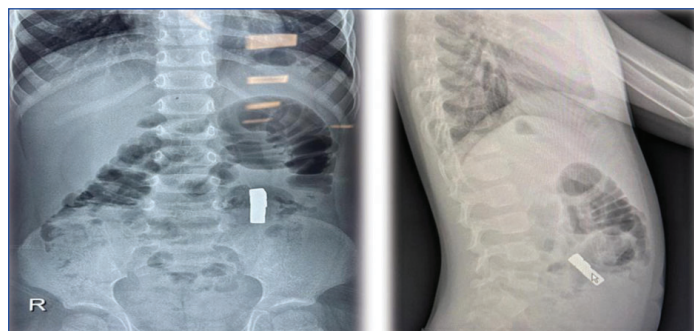
ABSTRACT

Ingestion of multiple high-powered neodymium magnets is a uniquely dangerous paediatric emergency. When distributed across non-contiguous bowel segments, transmural magnetic attraction causes progressive vascular compression, ischaemia, necrosis, and perforation. The incidence has risen sharply over the past decade, driven by the widespread availability of neodymium magnetic bead toy sets. Diagnosis is frequently delayed because children are often asymptomatic initially, creating a deceptive window during which bowel injury silently advances. A three and a half-year-old presented with bilious vomiting and fever without a reliable ingestion history. Plain radiograph revealed the stacked magnet sign across multiple abdominal quadrants. Conservative management failed the six-hour non-progression threshold, necessitating laparotomy. Magnets in the stomach, proximal jejunum, and transverse colon were drawing all three loops into stacked apposition with near-full-thickness ischaemia at each contact site. All were retrieved via gastrotomy and enterotomies; primary two-layer closure was performed. Recovery was uneventful. The stacked magnet sign mandates immediate surgical consultation. Adherence to the six-hour non-progression rule enabled timely laparotomy before frank perforation, which was directly responsible for the favourable outcome.

Keywords: Bowel ischaemia, Laparotomy, Paediatric foreign body, Six-hour rule, Stacked magnet sign

CASE REPORT

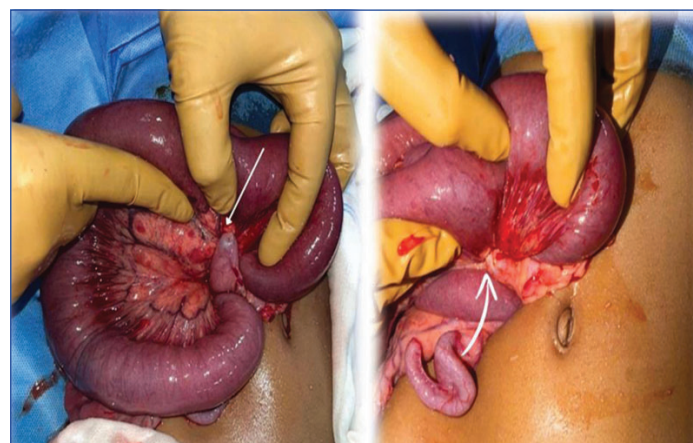
A three and a half-year-old child presented with a one-day history of persistent bilious vomiting and low-grade fever. No witnessed ingestion history was available. The child was alert and irritable, with a temperature of 99.6°F, pulse 119 bpm, respiratory rate 24/min, and SpO₂ 99% on room air. Abdominal examination revealed mild generalised distension with central tenderness and no peritonism. Abdominal ultrasonography demonstrated dilated jejunal loops and mesenteric lymphadenopathy. Plain abdominal radiographs showed the stacked magnet sign - a linear radiopaque configuration across multiple quadrants - indicating magnets in non-contiguous bowel segments [Table/Fig-1]. Conservative management was commenced under strict inpatient surgical monitoring with nasogastric decompression, intravenous fluids, and serial two-hourly radiographs. After six hours, bilious vomiting persisted with no radiological progression, satisfying the criterion established by Altokhais T for immediate operative intervention [1]. Emergency exploratory laparotomy was performed after informed parental consent.



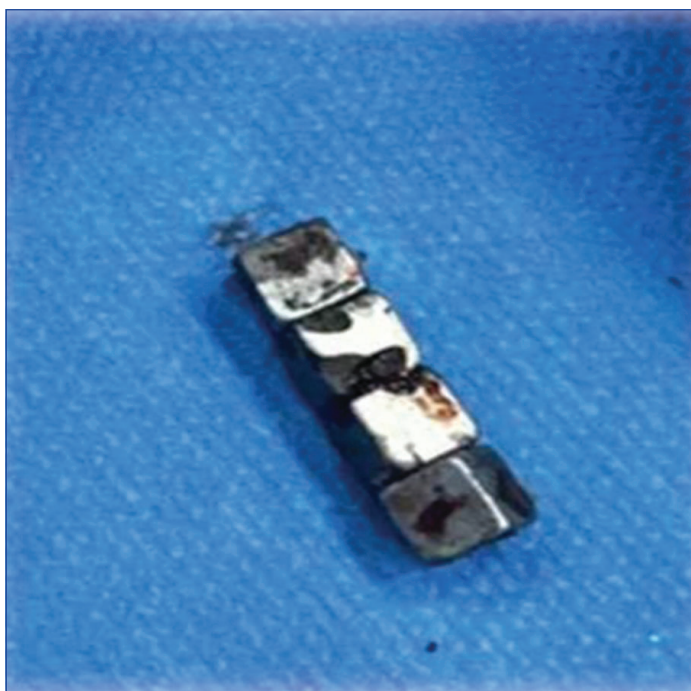
[Table/Fig-1]: Plain radiograph of the abdomen (Antero-posterior and Lateral view respectively) demonstrating a radiopaque metallic foreign body in the mid-abdomen consistent with an ingested magnet 'stacked magnet sign'. The lateral view confirms its intra-abdominal location anterior to the lumbar spine with no evidence of pneumoperitoneum.

Intraoperatively, via a supraumbilical transverse incision, four magnets, each measuring approximately 1×1×1 cm, were identified

within the stomach, proximal jejunum, and transverse colon - two magnets apposed within the stomach, and one each within the proximal jejunum and transverse colon. Transmural attraction had drawn all three segments into stacked apposition [Table/Fig-2]. Near-full-thickness ischaemia - serosal discolouration, mucosal haemorrhage, and mural thinning - was present at each contact site; no frank transmural perforation or free contamination was encountered. Bowel viability at each site was assessed by colour, peristalsis, and mesenteric pulsation on observation after magnet separation, confirming viability without need for resection. Magnets were retrieved via a gastrotomy and enterotomies, each measuring approximately 1 cm, at the jejunal and colonic sites. A leak test at each closure site was performed, confirming a watertight seal. Following retrieval, all bowel segments demonstrated satisfactory reperfusion [Table/Fig-3]. Primary two-layer closure - an inner layer of continuous absorbable suture and an outer seromuscular layer - was performed at each site, and a closed-suction drain was placed.



[Table/Fig-2]: Intraoperative photographs demonstrating multisegment magnetic entrapment, with multiple bowel loops drawn into stacked apposition via transmural magnetic attraction. Arrows indicate the points of magnetic apposition between non-contiguous bowel segments, where opposing magnets compress the intervening bowel walls. Note the haemorrhagic mesenteric congestion and serosal ischaemic discolouration at the contact sites.



[Table/Fig-3]: Retrieved specimen showing four neodymium magnets remaining in spontaneous linear stacked apposition even after surgical removal, illustrating the powerful inter-magnet attractive force responsible for multisegment bowel entrapment.

No bowel tissue was excised, and histopathological examination was therefore not indicated. The postoperative course was uneventful. The nasogastric tube was removed on postoperative day 3, following which oral liquids were commenced and gradually advanced as tolerated. The child was discharged in good condition on postoperative day 6. At review three months after surgery, he remained asymptomatic and thriving, with regular bowel habits and no complaints, a well-healed surgical wound, and no clinical features of intestinal obstruction. The parents were counselled regarding the hazards of high-powered magnetic toys and the importance of keeping such objects out of reach of young children.

DISCUSSION

This case exemplifies multisegment magnetic entrapment arising from staggered ingestion - each magnet advancing to a different bowel station before inter-segment attraction arrests migration and initiates ischaemic injury. The presentation in the current case - bilious vomiting and fever in a toddler with no witnessed ingestion history - closely mirrors the diagnostic challenge described by Stephenson SG et al., in which a paediatric patient with multiple magnet ingestion initially presented with non-specific abdominal pain, and the diagnosis was significantly delayed due to the absence of an ingestion history [2]. Similarly, Abuzneid YS et al., reported double-magnet ingestion presenting with abdominal pain and vomiting in a child where the ingestion history was unreliable, with the diagnosis ultimately established by plain radiograph [3].

Across these cases, including the present case, the unifying pivot was plain abdominal radiography: Signet ring sign/Stacked magnet sign, identified by Sodagum L et al., as pathognomonic for multisegment distribution, was present in the index patient and prompted immediate surgical consultation [4]. Arshad M et al., reported that even a two-segment configuration was enough to cause full-thickness bowel necrosis and entero-cutaneous fistula [5]. Despite three sites being involved in the index patient, frank perforation had not occurred at the time of laparotomy. This is not coincidental. Hayward RK and Saxena AK noted in their review of 136 surgical cases that perforation was found in 79%, but a subset

of patients reached the operating theatre before transmural breach, specifically those where surgical escalation was not delayed [6]. The present case falls into that subset, and the intact bowel wall at surgery reflects the timing of intervention, not any protective anatomical factor.

In the case series by Abuzneid YS et al., delayed presentation with established peritonitis necessitated bowel resection and stoma formation - a stark contrast to the primary closure without resection achieved in the index patient [3]. Nugud AA et al., further corroborated that delayed decision-making beyond six hours is an independent predictor of perforation and greater operative complexity [7]. The 2025 systematic review (n=130) confirmed surgical intervention in 95.5% of complicated cases, underscoring that conservative management is rarely definitive in multisegment entrapment [8].

With respect to operative approach, the present case was managed by open exploratory laparotomy with direct retrieval via gastrotomy and enterotomies - consistent with the predominant strategy identified by Hayward RK and Saxena AK, in which 60% of surgically managed cases underwent open laparotomy [6]. Bowel resection was required in 35% of cases in that review, reflecting situations where ischaemia had progressed to non-viable bowel [6]. That resection was not required in the present case, and primary two-layer closure was feasible at all three sites, distinguishes our outcome from the more complicated cases in the literature - most notably from Arshad M et al., where multisegment involvement necessitated resection and anastomosis [5].

CONCLUSION(S)

Multisegment magnet entrapment can be deceptively benign in a toddler and rapidly become fatal without timely intervention. The stacked magnet sign is a crucial finding towards the diagnosis. Preventing such cases ultimately requires both regulatory restriction of high-powered magnetic toy sets and greater awareness among treating clinicians.

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