

## Case Report

# Magnet Ingestion: A Case of Delay Presentation Leading to Bowel Perforation and Death

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**Abstract** Neodymium magnetic toys are gaining popularity these days and potential hazards of magnet ingestion in children must not be overlooked. Clinical presentations can be variable and subtle, which may lead to delayed diagnosis. Multiplicity and ingestion of multiple magnets at different timings can carry much higher morbidities such as bowel perforation. This is the first reported death related to magnet ingestion in Hong Kong.

**Key words** *Bowel perforation; Magnet ingestion*

### Case Report

A 10-year-old boy presented to the A&E with one week history of recurrent clear fluid vomiting, reduced oral intake and nil bowel opening for five days. He has moderate intellectual disability and autistic spectrum disorder.

On the day of admission, he was noted to have reduced responsiveness and confusion. He had a low-grade fever with tachycardia. Blood pressure and oxygen saturation were normal initially. He developed rapid deterioration while awaiting abdominal radiograph (AXR), with profuse coffee ground vomiting, tachypnoea and poor perfusion. He turned unresponsive and oxygen saturation became

undetectable. He ran into cardiac arrest soon requiring cardiopulmonary resuscitation (CPR) and intubation. Electrocardiogram showed asystole and he was resuscitated with saline boluses and intravenous epinephrine via intraosseous needle. Return of spontaneous circulation was achieved once, but he soon went into asystole again and eventually succumbed.

AXR (Figure 1) revealed a chain of bead-like foreign body over right lower quadrant. There was also central lucency suspicious of pneumoperitoneum. On further enquiry, mother recalled similar toys at home with magnetic beads, but she was not aware if the child had accidentally ingested any.

Blood tests revealed severe lactic acidosis, hyperkalaemia, and hyperphosphataemia. White cell counts were elevated. There was evidence of severe dehydration with haemoconcentration and renal failure. Toxicology screening and urine metabolic screening were unremarkable.

Post-mortem examination showed obstructive intestinal obstruction due to foreign body (a toy comprised of multiple consecutive magnetic beads, nine centimetres in total length and each measured four millimetres across, adhering one by one magnetically), with the transition point at the mid-ileum where the toy was found. The toy also led to bowel perforation (Figure 2), with transmural inflammation at the perforation site and patchy surrounding serositis microscopically. Extensive autolysis

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was noted in the bowel mucosa. In spite of the clinical finding of hyperphosphataemia, there was no definite gross or microscopic evidence of bowel infarction identified in the autopsy.

## Discussion and Literature Review

Amongst various kinds of foreign body ingestion, magnets can cause serious life-threatening complications.<sup>1</sup> Since the 21st century, neodymium magnetic toys have become more popular, and they are reported to be five to 10 times more powerful than traditional magnets.<sup>2</sup> They are usually marketed as transformable stress-relieving toys, easily reachable to children.

There is an increasing incidence of magnet ingestion and related morbidities and mortalities around the globe.<sup>1,3</sup> The potential hazards of magnet ingestion come to the attention of community as more physicians reported on their local experiences. The first local case report was published in 2019 featuring two cases of magnet ingestion requiring surgical intervention. This is the first reported death related to magnet ingestion in our locality.<sup>4</sup>

Findings of our case included leukocytosis, metabolic acidosis and haemoconcentration, which were

compatible with acute mesenteric ischaemia.<sup>5</sup> Presence of hyperphosphataemia and hyperkalaemia are often late signs and indicate extensive bowel infarction, suggesting poor prognosis and high mortality.<sup>6</sup>

Keys in managing magnet ingestion would be early identification and sensible risk stratification. Prompt diagnosis of magnet ingestion can sometimes be challenging, as young children are poor historians and parents often do not witness the ingestion. Clinical presentations can be variable, depending on the number of magnets ingested.<sup>7</sup> A significant proportion of them can be asymptomatic all along. Symptoms may emerge with time, but they can be non-specific, with vomiting and abdominal tenderness being the two most common complaints.<sup>7</sup> In rarer occasions, magnetic foreign bodies can enter tracheobronchial structures, causing respiratory symptoms such as wheezing and dry cough.<sup>8</sup> These symptoms can be overlooked by parents or physicians, leading to delay in presentation. Gregori et al's review in 2012 is one of the most comprehensive epidemiological reviews to-date.<sup>9</sup> Delay in appropriate diagnosis and patient referral is one of the most important risk factors for various morbidities such as fistulation and perforation of bowel.<sup>9</sup> Thus, high vigilance is needed when obtaining detail history in patients presenting with symptoms suggestive of possible foreign body ingestion.

The second key is to stratify the risk of potential morbidities and complications. First, it is advised that all symptomatic patients should be referred to pediatric surgeons for removal of magnets, by means of endoscopy or surgery.<sup>7</sup> Second, the number of magnetic ingestions is



**Figure 1** AXR showing bead-like foreign body and pneumoperitoneum.



**Figure 2** Magnetic beads piercing through ileal wall.

also important. For single magnet ingestion, clinical manifestation and risk of developing complication can be comparable to other usual foreign bodies. However, ingestion of multiple magnets can carry much higher morbidities. They should be closely monitored for emergence of symptoms, especially when there is delayed timing of ingestion of separated magnets,<sup>7</sup> as multiple magnets scattering at various locations of bowel lumen would generate attraction and sandwich bowel walls, causing pressure necrosis and compromising bowel viability. Risk of gut perforation can be up to 50% of cases.<sup>2</sup> If the history is unclear, radiographs can aid in diagnosis, but single radiological view at a single time point can sometimes be deceiving as there can be overlapping of two magnets. It is also reported that both X-ray and computed tomography are not sensitive enough to determine multiplicity of magnets or adequately exclude bowel wall impaction.<sup>7</sup> Thus, multiple radiological views should be adopted, and serial X-rays should be taken to observe for bowel movements and progression. High vigilance should be maintained for potential worse scenarios, and threshold for in-patient close monitoring should be low. Altokhais advocated that duration of observation should not exceed six hours in cases of asymptomatic multiple magnet ingestion,<sup>7</sup> highlighting the importance of early identification of non-progression and timely referral to surgeons for interventions.

Prevention is always better than cure. It is crucial for physicians, parents, and the government to recognise the unique hazards of magnetic toys. Doctors should not overlook the potential serious consequences of magnet ingestion and should be vigilant when history and clinical presentations are suspicious. Parents should ensure domestic safety and keep these toys out of reach of their young children. The policymakers should work with consumer council in evaluating our local Children's Products Safety Ordinance and consider legislations and guidelines to regulate the manufacturing and sales of magnetic toys, such as issuing warnings on packages or even banning their sales to pre-adolescents. Education campaigns should be designed to raise public awareness. In United States, a policy action in banning against the production and sales of aggregable magnet sets was introduced by Consumer Products Safety Commission in 2012.<sup>10</sup> Together with joint efforts from parents, physician groups and consumer protection advocates, a significant decrease of emergency department visits for magnet ingestions by children was observed since 2012.<sup>10</sup>

By reporting this first case of paediatric death in Hong Kong related to magnetic beads ingestion, we hope to alert our community, parents, and physicians to the potential hazards of magnetic toys. We urged that medical field should work closely together with legislative bodies to legally regulate the sales of magnetic toys to young children in our locality, such that similar tragedy can be prevented from recurring.

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## Declarations

The authors have no conflicts of interest to disclose.

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