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Not all foreign bodies are created equal

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ABSTRACT

Foreign body ingestions in children and adolescents can pose significant challenge both in terms of diagnosis and treatment. The pediatric scientific literature is relatively scarce and consists mostly of case reports and small case series, therefore making firm guidelines and management recommendations rather difficult. The type of ingestions seen may vary in different countries and it changes over time depending on implementation of safety measures, or introduction of new products. Lately, there has been a significant increase in the incidence of high-powered multiple magnet, and large disc battery ingestions. Both of these are associated with potentially serious complications including fatal outcomes. This paper briefly discusses some of the important aspects of critical foreign body ingestions, proposed management algorithms, and efforts necessary to increase public awareness in order to minimize complications and improve prevention.

During the last decade there has been a significant increase in critical foreign body ingestions with high rate of devastating complications. These primarily occur with high powered rare-earth neodymium magnet and large lithium disc battery ingestions.

Ingestion of magnets has been reported sporadically in the scientific literature for many years. However, within the last 10 years the number of cases has significantly increased. More importantly, the high rate and severity of complications has become quite worrisome. This likely stems from the fact that neodymium magnets used in toys are up to ten times more powerful when compared to ordinary magnets. In cases of multiple magnet or magnet and metallic object ingestion, this results in attraction of adjacent magnets through different bowel loops leading to serious bowel injury including perforation (Fig. 1) and can result in a fatal outcome. The first fairly large series, including 24 of these ingestions, was reported from United Kingdom in 2002 [1], followed by 20 more cases reported in the United States Centers for Disease Control and Prevention Morbidity & Mortality Weekly Report in 2006 [2]. That same year the United States Consumer Product Safety Commission (USCPSC) raised the recommended age for magnet toys from 3 to 6 years and then with continued increase in reported cases, banned sales of rare-earth magnets to children younger than 14 in 2009. Around the same time a mass production of these adult toys in sets of up to 1000 started due to the expiration of US patent (Fig. 2). Most recently, an informal poll of pediatric gastroenterologists participating in an on-line bulletin board forum revealed a series of more than 80 magnet ingestions of which one third required surgery for perforation repair and/or bowel resection. This prompted a formal survey in the fall of 2012 among the members of the North American Society for

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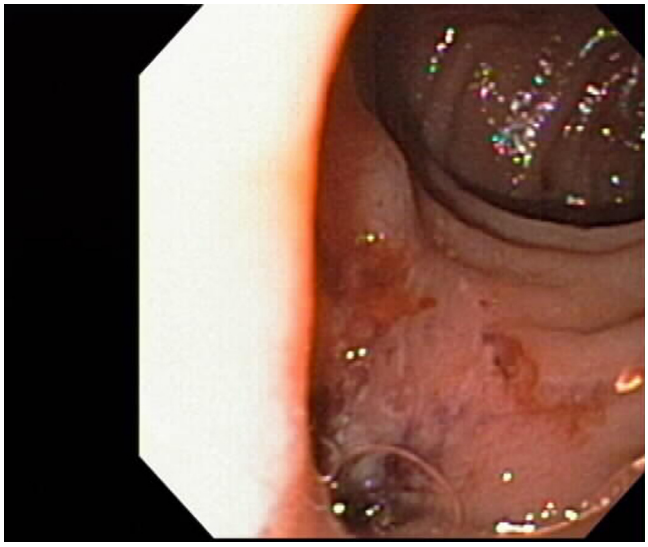

Fig. 1 – Endoscopic view of a duodenal perforation (left lower corner) in a 9-year-old boy who developed duodeno-colic fistula after multiple magnet ingestion

Pediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN). The survey concentrated on the period between 2008 and 2012 and detected 123 cases of which 102 occurred during just the last two years. More than half were in children one to three years of age (personal communication). The other large group consisted of older children who were pretending to have body art or piercing. Majority of magnets were located in the upper gastrointestinal tract, but some were in the small bowel including terminal ileum and colon requiring colonoscopic examination for removal. A very high proportion (25%) of the patients required surgery and 9% of those required further therapy due to complications.

The commentary published last year discusses a proposed algorithm (Fig. 3) for single and multiple magnet ingestion management [3]. Several points warrant emphasis. Obviously, the radio-opaque nature of magnets allows for easy detection and follow up of their progression with an x-ray. However, on occasion it is difficult to determine if there is one or more magnets present and in those cases multiple x-ray views may be necessary to aid the detection. Further, simple advice to avoid clothing with metallic objects may help passage of magnets while removal of other magnets from the child's environment may prevent further ingestion. The timing of ingestion is often not known and there is no data available yet to determine how long it takes for a bowel injury to develop. The algorithm uses an arbitrary 12-h cut-off, although injury has been documented to occur in isolated cases even earlier than that. In cases of prolonged time since ingestion it is important to involve our surgical colleagues early, either as a back-up during endoscopic intervention, or in case of a symptomatic patient where surgical removal might be a better initial therapeutic option. For multiple magnets within endoscopic reach cautious attempt should be made to remove them. No specific endoscopic tool has emerged as more favorable than others. Since magnets are quite powerful it may be difficult to separate them apart and occasionally difficult to determine if bowel mucosa is caught in-between. In extreme cases of multiple magnet ingestion it may become exceedingly difficult to remove them due to their clumped size. The above-mentioned survey found that more than 20% of patients had 10 or more magnets noted at the time of endoscopy. A retrieval net will likely be a useful tool, although variety of forceps types may be helpful, too. The magnets beyond endoscopic reach and in asymptomatic patients should be closely followed. The use of laxatives to aid passage is somewhat controversial and will likely need to be decided on case-to-case basis. Since multiple subspecialists may be involved with these ingestions starting with emergency room physicians or pediatricians and family practitioners, to ENT and general surgeons, radiologists, and pediatric gastroenterologists, concerted effort to develop multidisciplinary approach and protocols will likely result in better outcomes. Finally, prevention of ingestion is clearly the best strategy and it is of crucial importance to develop and implement an advocacy plan. NASPGHAN took an active role in this regard both in educating its members, the public, and reaching out to our sister professional societies. The patient brochure is available at the Societies' web site (http://www.naspghan.org) as well as the podcast on magnet management and treatment algorithm. In addition to this, frequent action and media alerts were sent, media spokespersons identified, newsletters published, and several NASPGHAN members met with USCPSC staff. These, among other measures as well as increased public awareness of high rate of complications contributed to the USCPSC's decision to engage manufacturers of neodymium magnets in discussion regarding voluntary recall. Majority of the manufacturers in the United States did proceed to voluntary recall while further legal action resulted in full voluntary discontinuation of high powered rare-earth neodymium magnet toys.

Fig. 2 – Neodymium magnet toy set

The second major type of foreign body associated with significant morbidity and mortality are batteries. In particular, 20-mm lithium disc batteries can have devastating effect if lodged in the esophagus. Recently, Litovitz et al. published two seminal articles on battery ingestions [4, 5]. The first one described outcomes with more than 56,000 battery