Journal Watch

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1. Nugud AA, Tzivinikos C, Assa A, et al. Pediatric magnet ingestion, diagnosis, management, and prevention: a European Society for Paediatric Gastroenterology Hepatology and Nutrition (ESPGHAN) position paper. J Pediatr Gastroenterol Nutr 2023;76(4):523–532. DOI: 10.1097/MPG.0000000000003702

The objectives of this position paper were to draw attention to the rising prevalence, the necessity for appropriate legislative bodies to enact legislation, to recall and outlaw the sale of these hazardous items, and to offer a clear and useful pathway for the diagnosis and treatment of magnet ingestion.

Over the past 20 years, an increase in the incidence of magnet ingestion has been recorded, corresponding to that of button battery ingestion. Several countries have seen an increase in cases of magnet ingestion during the coronavirus disease 2019 outbreak.

Magnet ingestion, especially if it occurs in conjunction with the simultaneous or staggered ingestion of several magnets or other metallic foreign bodies, particularly button batteries, has high morbidity. In contrast to swallowing a single magnet, swallowing multiple magnets carries a higher risk of compressing the vascular supply across bowel loops because of their mutual attraction, which can result in ischemia, tissue necrosis, perforation, fistula formation, obstruction, and, if untreated, death.

According to research by Kabre et al., once the space between the two magnets is cut in half, the force that magnets exert on one another increases fourfold.

A recent meta-analysis revealed that ingesting a battery and a magnet at the same time increased the likelihood of requiring surgical intervention compared to ingesting numerous magnets or ingesting other kinds of foreign bodies.

Rare earth elements are frequently found in high-powered neodymium (Nd) magnets, and they are frequently ordered in alloys that resemble crystals, like tetragonal 2 Neodymium: 1 Iron: 14 Boron buckyballs. Multiple Nd magnets can attach to each other across the walls of adjacent bowel loops due to their innately strong magnetism, potentially leading to intestinal necrosis, ileus, and eventually perforation. These magnets' size-to-strength ratio also contributes significantly to the morbidity and death they cause when consumed, and as a result, their relatively smaller size makes it easier for young children to consume them. Inadvertent ingestion has been documented in adolescents when used as an alternative to false piercings, such as lips, even though toddlers are in the index age range.

The algorithm's major focus was on the early collaborative consultation and management of gastroenterology and surgery, as well as the diagnosis of staggered/multiple magnet intake. The mainstay of diagnosis is a thorough history and physical examination with a high index of clinical suspicion of foreign body ingestion. When more than one magnet is ingested, the quantity and the time between ingesting each magnet component should be monitored. The risk of problems increases with the length of the interval and the number of magnets consumed.

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It is recommended to start with a collaboration of gastroenterology and surgical team approach. A plain abdomen radiograph is usually used to diagnose individuals who appear in emergency rooms with a history of witnessed or suspected magnet ingestion. The precise number and anatomical position of the swallowed magnets, however, cannot always be determined by this. If you see two or more tiny metallic items next to one another, you should be concerned that they could be magnets. The exact location of the magnets can be difficult to pinpoint, especially when they are radiologically in the upper abdomen. If the magnets are not below the level of the pelvic cavity, as seen in the abdominal X-ray, they should be considered to be potentially within upper gastrointestinal (GI) endoscopic reach. A thorough physical examination should include a look for blockage and perforation symptoms. A lateral abdomen X-ray can prove this in situations when only one magnet is consumed. In some circumstances, it may be necessary to do a computed tomography abdomen rather than magnetic resonance imaging (MRI) in order to more clearly define the anatomical location of the magnets and spot any potential issues.

If a single magnet is ingested and it is neither sharp nor large enough to block any part of the colon, no additional medical attention is necessary unless symptoms appear. Laxatives may be administered to hasten passage in situations where a single magnet fails to advance within 24 hours, as shown by repeated abdominal X-rays.

European Society of Gastrointestinal Endoscopy/European Society for Paediatric Gastroenterology Hepatology and Nutrition guidelines for pediatric endoscopy recommends urgent (<24 hours) removal of multiple magnets which are within endoscopic reach within 6 hours of ingestion.

In a few centers where antegrade enteroscopy is available, it may be theoretically utilized if deemed to be safe for the young age and small size of the patient.

When the Open Government Data Platform was unable to identify the swallowed magnets, inpatient osmotic laxatives may also be recommended in nonsymptomatic patients. A colonoscopy may be attempted in instances with advancement, no symptoms, and estimated location in the colon by X-ray, especially if there is a possibility of concurrent magnets in the small bowel. It's also important to prepare your bowels properly and use a second general anesthesia.

If endoscopy is not able to retrieve the magnet, then in case of radiological suspicion of perforation, it would be mandatory to remove it surgically.

Without evidence of a gastroenteric or gastrocolic fistula, an intramural rupture of the stomach wall seen following endoscopic evaluation should be repaired endoscopically with clips. Establishing a close follow-up to rule out pneumoperitoneum is also necessary.

While there are no set guidelines for antibiotic treatment, some publications have demonstrated that broad-spectrum antibiotics such as piperacillin/tazobactam (if there is no penicillin sensitivity) or meropenem are frequently used in cases of multiple magnet ingestion with problems. In symptomatic individuals with clinical evidence of blockage or perforation, as well as obviously in those with circulatory shock symptoms and intraoperative findings of peritonitis or purulent ascites, antibiotic treatment is required. Initially, elevated C-reactive protein and/or white cell counts should notify the doctor that antibiotics are required.

Gastric or enteric perforation, intestinal ischemia, volvulus, peritonitis, fistulae sepsis, and infrequent death are common side effects of repeated magnet ingestion. Additionally, reports of intestinal obstruction and volvulus following surgery have been made, necessitating repeat operations frequently within a short period of time. Additionally, the risk of surgical intervention is higher the smaller the size of the ingested magnets and the longer the interval of staggered ingestion. Perforations/fistulae can occur in some series in over one-third of magnet ingestion cases, with subsequent longer-term complications and repeated surgical interventions. Therefore, delaying the choice to remove numerous magnets that have been consumed and are still in place after a further 6 hours should be avoided. A tracheoesophageal fistula may develop in the event of concurrent magnet aspiration.

Since magnet ingestion does not yet have a precise International Classification of Diseases number, the entire scope of the problem is unknown. Additionally, there isn't a national database for magnet ingestion in the majority of the world's locations. Without this incidence data, it is difficult to make a compelling case for passing legislation. In order to address this issue, community and accident prevention agency actions are essential, with social media influencers and the public transmission of knowledge via social media platforms serving as an additional platform.

Community awareness programs may be crucial in boosting public understanding of the issue, even though legislative mandates can help lessen its burden.

2. Chanpong A, Thapar N. Pediatric neurogastroenterology and motility: moving rapidly into the future. J Pediatr Gastroenterol Nutr 2023;76(5):547–552. DOI: 10.1097/MPG.0000000000003721

In this review article, the authors have described the recent developments in the field of Pediatric Neurogastroenterology and motility. For many of the most prevalent or severe GI motility problems that plague children, the coming decade holds great potential.

New and emerging data have helped to sharpen the focus on the etiopathogenesis of disease, emphasizing the central role of the microbiota-gut-brain axis and the variables (such as viral infectious agents and inflammation) that contribute to the damage and reprogramming of this system, particularly in infancy. The disruption of the microbiome in early life is expected to play a role and will prove to be an important focus in the next years, though we don't know yet the processes of early life programming of motility disorders.

It is feasible that dysmotility disorders that appear in infancy, such as pediatric intestinal pseudo-obstruction (PIPO), could be caused by dysbiosis that manifests as episodes of necrotizing enterocolitis with significant and persistent disruption of the enteric nervous system (ENS). The deoxyribonucleic acid of the most frequently identified neuropathic viruses has been found in the glial and neuronal cells of the myenteric plexus in the small intestine and colon of patients with chronic intestinal PIPO. These viruses include the human polyomavirus, also known as the John Cunningham virus, herpes simplex, Epstein–Barr, cytomegalovirus, varicella-zoster virus, and flaviviruses. Herpes simplex, toxoplasma, and ureaplasma parvum infections—all of which are frequently linked to chorioamnionitis—have been shown in animal models to cause ENS impairment in the fetus.

Turnaround time for viral polymerase chain reaction is lengthy. Viral fast antigen tests still have time to develop in the coming decades, especially for GI illnesses. Similar to the coronavirus pandemic, there is a push to develop a fast, accurate, and widely accessible diagnostic test that can identify pathogen structural components

Improved access to damaged or malfunctioning tissue would help us better understand and evaluate gut motility diseases, which would help us better target therapy. With the increased use of minimally invasive procedures (such as laparoscopic-assisted and endoscopic intestinal biopsies and peroral endoscopic myotomy) and better imaging to facilitate assessment and guide sampling, this access to damaged or malfunctioning tissue is likely to continue to improve in the coming decades.

Although histopathology has historically been used as the primary method for the evaluation of tissue, a number of well-established and cutting-edge complementary techniques have recently emerged to enable better and more in-depth evaluation of intestinal neuromuscular tissue, as well as of single cells and cell culture. These include anything from *in vivo* research using various genetically modified animal models to the use of *in vivo* imaging techniques (like optogenetics) to make it easier to track neuronal and glial activity. *Ex vivo* examinations of tissue or cell cultures (generic, for example, from the dissociated gut, or selective, for example, ENS alone) or produced organoids are likely to make quantitative or functional assessments of neuromuscular components (for example, ENS) easier.

Organ bath tissue contractility testing has the potential as a clinical tool to identify and characterize abnormalities of intestinal motility. Its use has been incorporated into clinical practice as an *in vitro* approach utilized mostly in animal investigations to precisely characterize the pathophysiology behind GI motility problems and evaluate pharmaceutical responses. Tissue-based approaches enable the development of regenerative medicine techniques [such as three-dimensional (3D) organoid models and organ-on-a-chip], as well as the genetic manipulation of cellular components *in vitro*.

Molecular phenotyping is advancing thanks to the application of "omic" technologies (genomics, transcriptomics, proteomics, metabolomics, etc.). Improvements in the understanding of the genes linked to a variety of GI motility diseases have considerably enhanced genomics. In the era of whole exome sequencing, it may be possible to identify and confirm GI motility disorders through genetic testing during the prenatal period, particularly in those with abnormal antenatal imaging, for example, megacystis (a longitudinal bladder diameter of ≥7 mm measured from the bladder dome to the bladder neck in the midsagittal plane on an ultrasound scan) or urinary tract abnormalities in megacystis-microcolon-intestinal hypoperistalsis syndrome or polyhydramnios in esophageal atresia. Therefore, early-stage new therapies like gene therapy or stem cell transplantation may be advantageous for these kids.

Manometry of the GI tract has been the foundation of testing. With the development of more physiological and reliable procedures, including several technologies (such as manometry impedance), as well as improved data interpretation and disease sub-classification, the utility of manometric testing is anticipated to be increased and facilitated. Using pressure topography metrics from high-resolution mammography (HRM), Chicago categorization version 4.0 has provided an upgrade to reduce ambiguity from earlier versions to better characterize esophageal dysmotility. A more precise understanding of oropharyngeal and esophageal pathophysiology is also made possible by metrics on distension pressure and bolus flow analyzed on cutting-edge platforms like Swallow Gateway, combining HRM with impedance approaches. This is especially true for the pediatric population.

An enhanced breadth of contractile parameters has been incorporated in the study of antroduodenal manometry, a reference method for the evaluation of small intestinal dysmotility, and a corresponding score (GLASS) has been developed. As a result, it was discovered that the diagnostic and PIPO subtypes more closely matched histological findings from full-thickness small-intestinal biopsies. This improved assessment has to be validated in the upcoming years.

Wiklendt et al. has made advancements in the automated analyses of colonic manometry, which may shorten analysis times and enhance recognition of colonic pressure waves' cyclic nature.

The British and European Societies of Pediatric Gastroenterology, Hepatology, and Nutrition's motility working groups have provided indications and protocols for pediatric anorectal manometry as well as suggested parameters for interpretation and reporting in children. We may expect to witness advancements in HRM procedures for kids in the upcoming years, including the amalgamation of additional test parameters and analyses, as well as a better classification of the variety of GI motility problems.

A variety of cutting-edge and newly developed instruments and technologies are now readily available, and they have the potential to enhance diagnosis. These include minimally invasive techniques (such as MRI, ultrasound, wireless capsules, and omics) and/or cutting-edge methods that can capture GI motility in a more optimal way, classify it using pediatric-specific criteria, and analyze it using automated and artificial intelligence (AI) techniques like enhanced scoring systems. They also comprise a variety of instruments that are now used in lab and research settings (e.g., tissue contractility and electrophysiology).

The functional lumen imaging probe (FLIP), a revolutionary technique utilizing high-resolution impedance planimetry technology, has evolved in recent years. It consists of an esophageal functional luminal imaging probe and endoluminal functional luminal imaging probe devices that are useful for assessing the mechanical properties of the intestinal wall, such as esophageal distensibility and compliance. FLIP technology can be used in conjunction with HRM. FLIP may also be used therapeutically to treat esophageal motility issues. This instrument may be used to assess the physiology of the pylorus and the anorectum as part of routine clinical evaluations of pediatric patients with esophageal problems

Older methods like electrogastrography have experienced a slight return thanks to improved technologies and analyses. A promising approach for determining the electrical function of the stomach is high-resolution electrical (gastric) mapping. In patients with functional dyspepsia, gastroesophageal reflux disease (GORD), persistent nausea and vomiting, and gastroparesis in both adults and children, it enables the detection of various patterns of stomach dysrhythmia. Future study is needed to determine its usefulness and to answer issues about how dysrhythmias affect stomach motility and result in symptoms in children.

Ultrasound and cinematic-MRI are two research methods that have undergone technological advancements and developments towards fresh, less invasive methodologies during the past ten years. Cine-MRI is a noninvasive, radiation-free approach for diagnosing and evaluating GI function, particularly motility. Based on variations in bowel lumen diameter, Menys et al. evaluated the contractile activity of the stomach, small bowel, and colon using spatiotemporal motility MRI. Additionally, it may be useful when paired with manometry for research on children who have constipation.

Additionally, Nottingham Young Person's Advisory Group has developed an MRI mini-capsule device to measure entire gut transit time as an improvement to MRI for the measurement of motility. The new test, which can be used in place of the X-ray radio-opaque marker test, which exposes patients to radiation and has a hazy definition of colonic anatomy, allows for better marker localization than two-dimensional X-ray abdominal films, especially when bowel loops overlap.

Utilizing cutting-edge ultrasound probes, GI ultrasonography has demonstrated improved value in the diagnosis of diseases such as inflammatory bowel disease as well as the assessment of flow through the stomach (for instance, in gastroparesis). In situations like eosinophilic esophagitis, endoscopic ultrasonography may also reveal information about esophageal motility. Additionally, a recent study found that point-of-care ultrasound's transrectal diameter could eventually take the place of abdominal radiography in diagnosing nasal constipation in children who arrive with abdominal pain. Key techniques created at research facilities have recently been used more in clinical practice.

An ambulatory assessment of both whole gut and regional transit durations under almost normal physiological conditions is possible with the radiation-free and minimally invasive Motilis 3D-transit system (3D-transit). Both adults and children have been shown to benefit from it, and normative standards have been developed. With the advent of cutting-edge methods like the spirulina breath test, noninvasive assessments of stomach emptying or entire gut transit are beginning to show promise.

Wireless motility capsules have more recently been approved for usage in children (8 years old) to simultaneously assess GI motility and transit.

Gastroenterology's use of AI has made quick strides and may one day be integrated into routine clinical practice in the years to come. During upper and lower GI endoscopy, including small bowel capsule endoscopy, AI not only aids in the identification of intestinal lesions (such as polyps or cancerous lesions) but can also evaluate primary esophageal motility disorders and related diseases, including GORD and eosinophilic esophagitis. Recently, Czako et al. proposed using AI methods to automatically analyze esophageal HRM based on the Chicago classification. They reported 90% accuracy in detecting probe positioning failure and pinpointing the precise class of the integrated relaxation pressure. AI may be able to identify and categorize GI motility disorders and reduce human intervention and interobserver variability as we learn more about diseases and their classification.

As a result of the advancements in disease knowledge and diagnosis, the treatment of GI motility disorders will increasingly focus on targeted and personalized medicine, supported by the application of cutting-edge (such as neuromodulation), curative (such as gene editing and reparative medicine), and multidisciplinary (such as tissue engineering) approaches. However, only a small portion of the pharmacotherapy trials that are conducted on adults eventually benefit children. Despite the development of innovative medications during the ensuing years, it will still be necessary to properly characterize the target disorders before their usage. In the same vein, such categorization might enable us to "repurpose" already accessible medications for more targeted illnesses. This may be the case, for instance, with the prokinetic drug prucalopride, which proved ineffective in children with real abnormalities of colonic transit as opposed to functional constipation.

Bioelectrical neuromodulation, a cutting-edge gadget technology that modifies the activity of the nervous system, is one of the "emerging" treatment possibilities for the future. Promising neuromodulation-based treatments include gastric electrical stimulation, abdominal transcutaneous electrical stimulation, sacral nerve stimulation, posterior tibial nerve stimulation, and auricular nerve stimulation, though more research is still needed to support their use in children. As a cutting-edge noninvasive technique, transcutaneous auricular vagal nerve stimulation represents an exciting advancement in the field. Its effectiveness was first assessed in healthy adults and adolescents with functional GI problems and irritable bowel syndrome, with more recent evaluations in kids with cyclic vomiting syndrome, before being tested in more general populations. Thus, electrical neuromodulation has enormous therapeutic promise. To avoid off-target effects, it could be improved (for instance, using optogenetics) to be more specialized and targeted to smaller nerve branches or organ-specific nerves.

The development of regenerative medicine and gene therapy is possibly one of the most promising areas for the field in the last 10 years. The use of neural stem cell therapy in *in vivo* investigations on animal models of Hirschsprung disease (HSCR) and colonic dysmotility has demonstrated effective functional outcomes from both human pluripotent and intestine-derived progenitors. Techniques to improve neural progenitors *in situ*, such as the use of therapeutic enemas, may support these. The fusion of technologies may make it easier to bioengineer sections of the GI tract. It is still unknown whether these regenerative medicine techniques will actually enhance outcomes on their own or act as vital supplements to surgery for HSCR and other GI motility problems.