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REVIEW ARTICLE

Gastroenterology

Global insights on the diagnosis, management, and prevention of pediatric ingestions: A report from the FISPGHAN expert panel

Michael A. Manfredi[1] | Reinaldo P. Alvarez[2] | Katsuhiro Arai[3] | Huma A. Cheema[4] | Andy Darma[5] | Mamoun Elawad[6] | Claudio Iglesias[7] | Matjaz Homan[8] | Omar I. Saadah[9] | Catharine M. Walsh[10] | Lissy de Ridder[11]

Correspondence
Michael A. Manfredi, Division of Gastroenterology, Hepatology, and Nutrition, Childrens Hospital of Philadelphia, University of Pennsylvania School of Medicine, Philadelphia, PA, USA.
Email: manfredim@chop.edu

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Abstract

This is a comprehensive review of pediatric foreign body (FB) ingestions, emphasizing the global burden, epidemiology, and management strategies. Predominantly occurring in children under 6, with a peak between 6 months and 3 years, these incidents pose significant health risks with substantial regional variations in ingested objects—ranging from household items to caustic substances. The pathophysiological effects of ingestions are outlined, highlighting specific dangers associated with button batteries, sharp objects, and caustic agents, which can lead to severe tissue damage and long-term complications. A survey of (70) pediatric gastroenterologists from FISPGHAN societies revealed varied regional practices in the frequency of different FB ingestions with food impaction highest in North America and Ocenaia and caustic ingestion more common is Asia. Button batterers were serious concerns across all regions. Management approaches, specifically intubation practice varied across regions. A review of management protocols for different types of ingestions are provided, emphasizing the urgency of endoscopic removal and follow-up care. Prevention strategies are critical, with a focus on public health interventions, legislation, and education to mitigate the risks associated with FB and caustic ingestions. This report underscores the need for enhanced preventive measures and uniform management guidelines to reduce the incidence and improve outcomes of pediatric ingestions worldwide.

For affiliations refer to page 285.

[Correction added on 22 July 2025, after the first online publication: Article format has been updated.]

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KEYWORDS
button battery, caustic, foreign body removal, magnet ingestion, water beads

1 | INTRODUCTION

Foreign body (FB) and caustic substance ingestions are common pediatric medical issues worldwide, with severity ranging from mild cases requiring observation to severe cases needing urgent intervention. Healthcare providers must assess each patient and take appropriate action. This report from the Global Federation of International Societies of Paediatric Gastroenterology, Hepatology and Nutrition (FISPGHAN) reviews the epidemiology, pathophysiology, outcomes, clinical assessment, and best management practices for pediatric ingestions globally. FISPGHAN (The Federation of International Societies for Pediatric Gastroenterology, Hepatology, and Nutrition) is composed of six regional pediatric GI societies: APSPGHAN (Asia-Pacific Society for Pediatric Gastroenterology, Hepatology, and Nutrition), ESPGHAN (European Society for Pediatric Gastroenterology, Hepatology, and Nutrition), LASPGHAN (Latin American Society for Pediatric Gastroenterology, Hepatology, and Nutrition), NASPGHAN (North American Society for Pediatric Gastroenterology, Hepatology, and Nutrition), CAPGAN (Commonwealth Association for Pediatric Gastroenterology and Nutrition), and PASPGHAN (Pan Arab Society for Pediatric Gastroenterology, Hepatology, and Nutrition).

What is Known

- Pediatric foreign body and caustic substance ingestions are a significant health issue globally, especially in children under 6.
- Specific ingested items, such as button batteries and magnets, are known to cause rapid and severe tissue damage, often requiring urgent medical intervention.
- Current management practices lack uniformity, contributing to varied outcomes and complications.

What is New

- This global review provides epidemiological insights and management protocols with emphasis of minimum standards for pediatric ingestions.
- It emphasizes the need for uniform management guidelines and enhanced preventive strategies, including public health interventions and legislation.
- New global survey data expose significant regional differences in ingestion types and response protocols.

2 | METHODS

The FISPGHAN Council as part of the 2024 World Congress prioritized pediatric ingestions as a global issue and appointed an expert team, including two chairs, to address it. Experts from all member societies of The FISPGHAN World Congress collaborated through teleconferences and digital communication. Subtopics were chosen by consensus, and each coauthor drafted sections as narrative reviews, informed by electronic literature searches. A survey was developed by the committee to gain insight into regional issues related to ingestions and management practices. It included basic questions about ingestion cases in different areas and common removal techniques. Each FISPGHAN committee member distributed the survey to society members across various regions within their respective societies, ensuring broad geographic representation., The authors acknowledge the limitations of this survey. These findings are intended to offer an initial descriptive overview of global practices rather than definitive conclusions. Further research with larger, more representative samples is necessary to better characterize international variations in ingestion management. In developing endoscopy and treatment recommendations, we reviewed relevant societal papers and worked together with FISPGHAN co-authors to ensure the inclusion of societal position papers recommendations that could be applicable to their respective global region. Co-chairs reviewed and revised the drafts, incorporating feedback and references, leading to a final manuscript approved by all authors and the FISPGHAN Council.

3 | RESULTS

3.1 | Epidemiology

FB ingestion is a significant global public health concern in children, with prevalence and incidence rates varying. Approximately 80%–90% of cases occur in children under 6 years old, peaking between 6 months and 3 years due to increased mobility, exploratory behavior, and lack of coordination.[1,2] Boys are more frequently affected than girls.[1]

The types of ingested items vary widely, including coins, toys, batteries, magnets, caustic agents, and household objects, influenced by the child's environment.[3–6] Risk factors include lack of supervision, inadequate childproofing, developmental exploration, and behavioral or developmental disorders.[7]

Caustic ingestions are common in pediatrics. In 2019, the American Association of Poison Control Centers reported 180,000 caustic exposure incidents.[8] From 1985 to 2009, the National Poison Data System recorded a 4.4-fold rise in clinically significant battery ingestions and a 6.7-fold increase in major or fatal outcomes.[9,10] Magnet-related injuries also surged between 2002 and 2011.[11,12] In Taiwan, 16,001 corrosive injuries were recorded from 1996 to 2010, with 7.8% involving children under 18.[13] In Galicia, Spain, caustic ingestions accounted for 4.8% of child accidents requiring medical attention among a population of 0.5 million children under 14[14]

Global epidemiological data are limited and skewed towards well-resourced centers, often underreporting cases in developing countries. In developing countries, ingestion, especially of caustic substances, is often underreported.[15] The available information tends to be skewed towards well-resourced centers, likely not reflecting the true situation. The existing literature highlights that children under 5 years of age were most frequently injured, with boys exceeding girls. Sodium hydroxide was the most reported corrosive agent, followed by kerosene, sodium hypochlorite, and generic household chemicals.[15,16] Conversely, acid ingestion was more common in India due to its affordability and widespread availability in households as toilet cleaners and antirust compounds.[17,18] In countries like Gambia and Nigeria, corrosive ingestion accounted for a significant proportion of pediatric admissions, highlighting its impact on childhood mortality in these regions.[19,20]

Over the past decade, superabsorbent water beads have emerged as a new FB health hazard. Between 2013 and 2023, an estimated 6022 cases of water bead ingestion were reported in the United States, with a median ingestion age of 3.2 years (13 JPGN ref). The incidence of ingestions has increased significantly since 2020 and has not declined since the pandemic. Fifty-two percent of cases involved multiple water beads, and while 91% of these cases were uneventful, with removal and discharge, 9% required hospital admission and escalation of care.[21] There have been three reported deaths related to water bead ingestion.[21–23] Lastly, secondary to the toxicity from Polyacrylamide there have been cases of neurotoxicity and defeaness.[22,23]

3.2 | Survey of pediatric gastroenterologists

As part of the FISPGHAN working group initiative, a survey was distributed to colleagues by representatives from each participating society. South America contributed the largest share of respondents, followed by similar numbers from Asia, Europe, North America, and the Middle East. Oceania (Australia/New Zealand) had the smallest representation (Figure 1).

Respondents ranked 10 types of FBs by frequency. Regional comparisons (Figure 2) highlighted variations, likely reflecting true differences in incidence. Non-sharp items were the most common ingestions across all regions. Sharp items and food impactions also ranked high, though with regional differences. Food impaction was more frequent in North America and Oceania, possibly due to higher rates of Eosinophilic Esophagitis. Button battery (BB) ingestions were common everywhere, with the Middle East reporting the highest median rank and Europe the lowest. Caustic ingestions

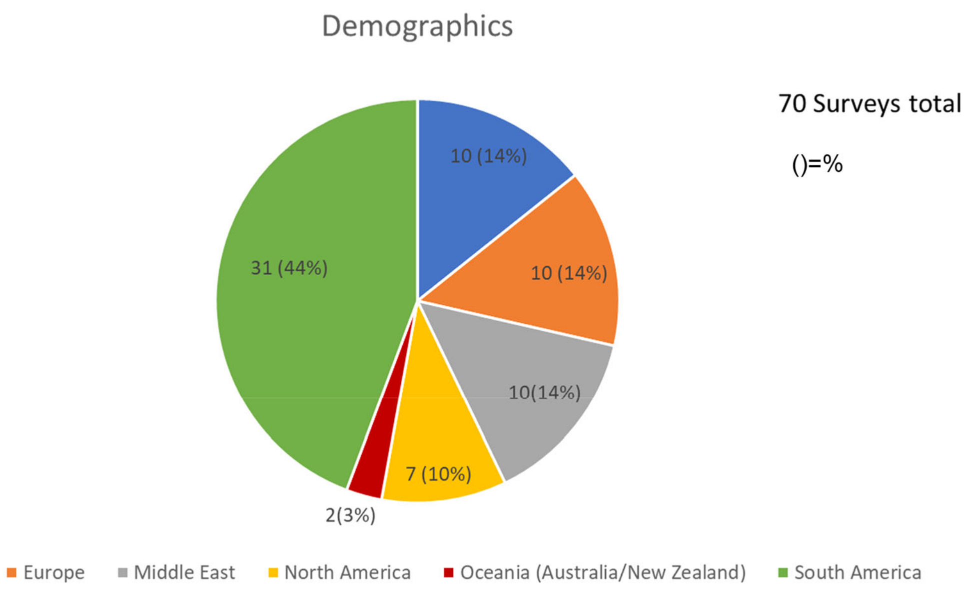


FIGURE 1 Geographic location of survey respondents.

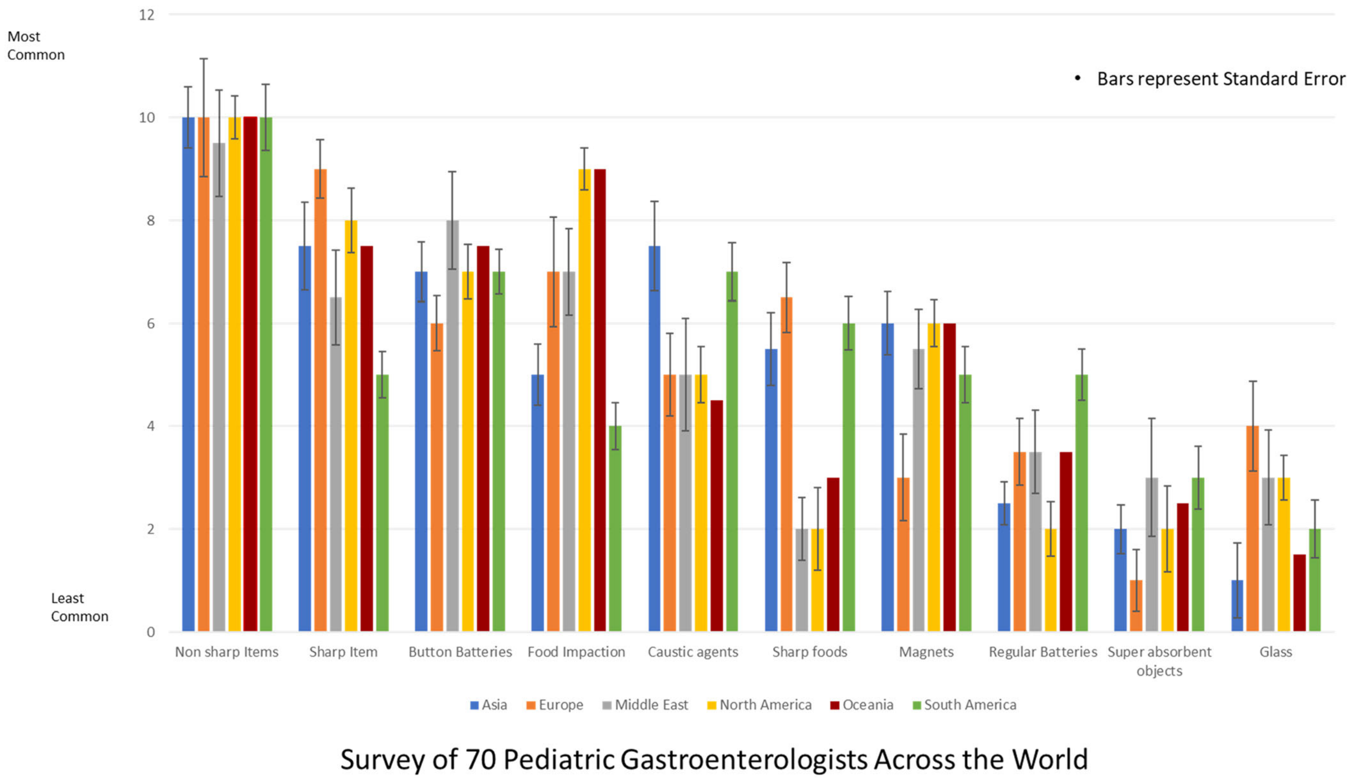


FIGURE 2 Reported frequency of pediatric ingestions by type across geographic regions.

TABLE 1 Regional practices of intubation during upper endoscopy for pediatric ingestion.

	Do you typically intubate your patients when you encounter a...		
Region (*N*)	**Foreign body in the esophagus (% yes)**	**Foreign body in the stomach (% yes)**	**Caustic ingestion (% yes)**
Asia (*N* = 10)	80	80	90
Europe (*N* = 10)	100	80	89
Middle East (*N* = 10)	80	70	78
North America (*N* = 7)	100	100	100
South America (*N* = 31)	74	69	71
Total (*N* = 70[a])	81	75	79

[a]Two surveys from Australia and New Zealand.

were more frequently reported in Asia and South America. Most caustic ingestions involved alkaline substances, except in Asia, where acid ingestions were more common.

The survey also examined intubation practices during upper endoscopy for FB and caustic ingestions (Table 1). For esophageal FBs, all respondents from Europe and North America reported intubation, while other regions reported rates of around 80%, with South America at 74%. Intubation rates for stomach FBs were lower overall, except in North America, which reported 100%. Rates in other regions included Asia and Europe (80%), the Middle East (70%), and South America (69%). For caustic ingestions, North America again reported the highest intubation rate (100%), followed by Asia (90%) and Europe (89%). The Middle East (78%) and South America (71%) had lower rates. Reasons for these regional differences remain unclear, as this was beyond the scope of the survey. Additionally, it is unknown whether variations in intubation practices resulted in more or fewer adverse events. This remains an important area for further research.

The survey also addressed delayed medical responses to ingestions (Figure 3). Delayed medical response was defined as presenting for medical care greater than 48 h from onset of ingestion or development of symptoms if ingestion time was not known.

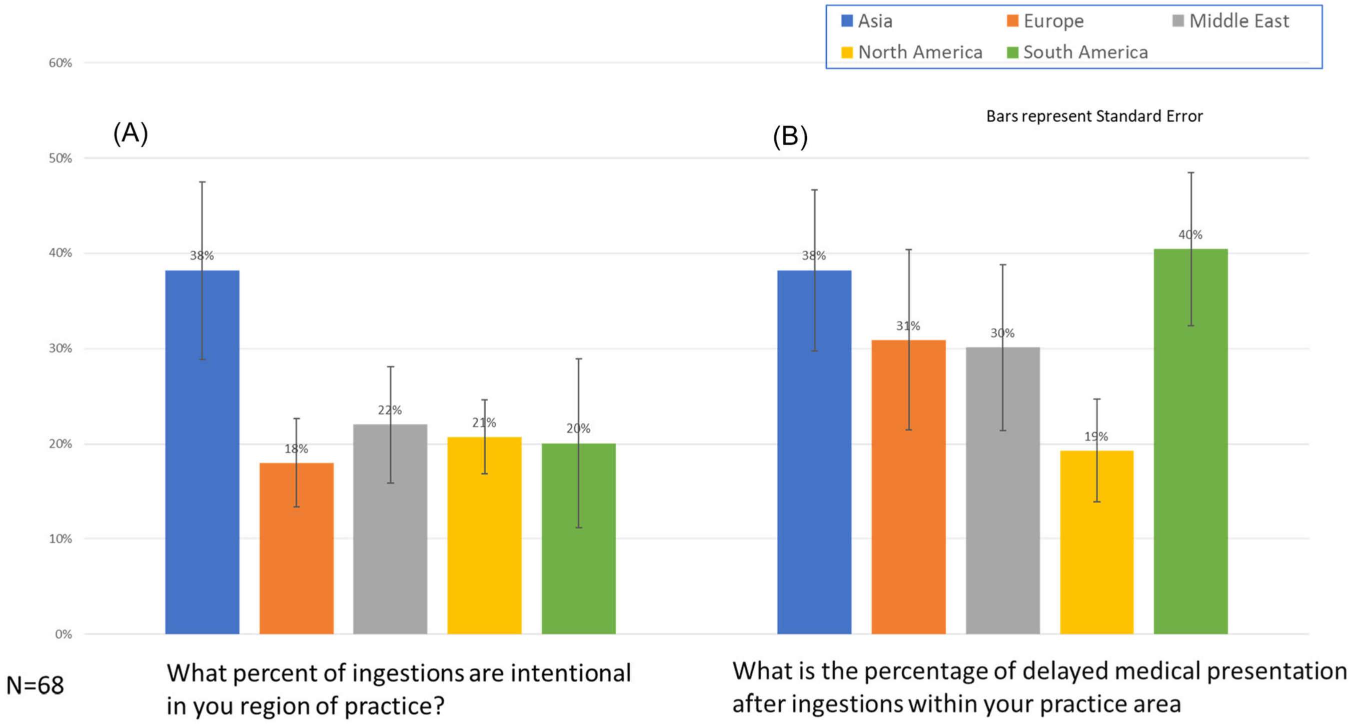


FIGURE 3 Regional variation in (A) intentional ingestions, and (B) delayed presentations of pediatric ingestions.

South America and Asia reported the highest rates of delayed presentations, averaging 40% and 38%, respectively. Asia also reported the highest percentage of intentional ingestions (38%), compared to rates of 18%–22% in other regions.

3.3 | Pathophysiology

Injuries from ingestions in children are influenced by the type and location of the ingested agent or FB. Below is an overview of the mechanisms for common injuries:

3.3.1 | FBs

3.3.1.1 | *BBs*

Tissue injury from BBs is caused by electrolysis and the production of hydroxide ions.[24] The electrical potential of the BB generates a water hydrolysis reaction at the negative pole when it contacts the adjacent tissue, creating a circuit between the battery's poles. This reaction rapidly increases local pH to 12–13 due to hydroxide ion accumulation, leading to liquefactive necrosis and deep tissue caustic injury.[25]

The reaction starts quickly within 15 min and peaks about 4 h after ingestion. The BB's large conductive surface area, small volume, short electrode distance, and high mucosal conductivity contribute to its potent mucosal damage.[26] Necrosis can also occur on the positive electrode side of lithium batteries in acidic environments, forming an eschar that limits injury to the inner esophageal layers. However, battery removal can cause further mechanical damage due to strong mucosal adherence to the positive electrode.

3.3.1.2 | *Sharp foreign objects*

The outcomes of sharp object ingestion depend on factors such as size, type, location in the gastrointestinal tract, and the patient's underlying medical conditions. Ingesting multiple needles or sharp objects often results in complications like gastric and intestinal perforation. Sharp edges can damage the gastrointestinal walls, leading to erosions, ulcers, lacerations, or severe cases of perforation.[27] Larger or irregularly shaped objects can obstruct the gastrointestinal tract, impeding the passage of food, fluids, and digestive secretions. In some cases, intraluminal gastrointestinal bleeding may occur.[27]

3.3.1.3 | *Magnets*

Ingesting multiple magnets, especially high-powered rare earth magnets made of iron, boron, and neodymium, can cause surgical emergencies. The magnetic attraction between magnets can trap intestinal walls, leading to ischemia, necrosis, perforation, fistula formation, obstruction, and peritonitis.[28]

3.3.1.4 | *Super absorbent water beads*

Superabsorbent polymers are cross-linked hydrophilic polymers, often cross-linked with sodium polyacrylate. When exposed to water, these polymers can expand to 150–1500 times their dry size, posing a significant risk of mechanical complications such as bowel obstruction, perforation, and death when ingested.[22,23,29] In addition to these physical dangers, water beads also present a toxicological risk. Polyacrylamide, a common component of water beads, is synthesized through the polymerization of acrylamide monomers. While polyacrylamide is marketed as nontoxic, residual acrylamide monomers can pose serious health risks due to their known neurotoxicity.[22,23] Some uses of polyacrylamide are regulated to limit acrylamide contamination, but there are no specific regulations governing residual acrylamide levels in water beads, further increasing the potential for harm.[23]

3.3.2 | Caustic agents

Caustic substance ingestion can cause immediate injuries in the mouth, esophagus, stomach, and small intestine, as well as medium-term complications like stenosis and long-term risks such as cancer. The extent of damage depends on factors like substance concentration, pH, viscosity, location, and contact time.[30]

3.3.2.1 | *Alkaline agents*

Alkaline substances, often colorless and odorless, are easily ingested in large amounts. A pH >11 may cause burns, while a pH >12.5 leads to injury regardless of concentration.[31] Alkaline agents cause liquefaction necrosis by saponifying lipids, penetrating deep into submucosal and muscular layers, leading to vessel thrombosis, fibrosis, and potential perforation.

3.3.2.2 | *Acid agents*

Acids with a pH <2 cause coagulation necrosis through ischemia. The formation of an eschar may limit deeper penetration and reduce the risk of perforation. Due to their bitter taste, acids are typically ingested in smaller amounts during accidental exposures. Their lower viscosity promotes rapid esophageal clearance but increases the risk of gastric injury, often presenting as hemorrhage in the antrum.[32]

3.4 | Clinical presentation and medical evaluation

3.4.1 | FBs

Management of ingested FBs depends on the patient's symptoms, time since ingestion, and the type of object. Immediate medical history should identify underlying conditions, medications, allergies, and prior anesthetic reactions. Physical examination focuses on respiratory status and abdominal symptoms.

Patients with respiratory symptoms, difficulty managing secretions, or repeated vomiting require urgent management. Signs of an acute abdomen necessitate emergent surgical consultation, while respiratory distress requires consultation with otolaryngology or surgery.

In a 2006 study of 555 children with esophageal FBs, common symptoms included dysphagia (37%), drooling (31%), and choking (17%).[33] Other symptoms were cough, abdominal pain, fever, chest pain, wheezing, stridor, vomiting, and refusal to eat. Objects at the upper esophageal sphincter often present with drooling, vomiting, and dysphagia, while those at the lower esophageal sphincter typically cause pain.[34] Asymptomatic cases account for 10%–50% of ingestions in large pediatric studies.[33,35,36]

3.4.2 | BBs

Lithium BB can cause severe esophageal injury within 15 min of becoming lodged, necessitating prompt removal and intervention.[37] If a child has ingested a BB within the last 12 h and can still swallow liquids, certain steps may be taken before removal without delaying hospital presentation or endoscopy.

At home, caregivers may give 10 mL (two teaspoons) of honey every 10 min, up to six doses, until the child reaches a hospital. However, honey should not be given to children under 1 year old due to the risk of botulism.[38–40] In a clinical setting, while preparing for endoscopy, honey or sucralfate may be administered. These measures are adjunctive and must not delay the removal of the battery, which should be performed as soon as possible.

3.4.3 | Super water absorbent water beads

Ingestion of water beads can present with signs of bowel obstruction. Common symptoms include vomiting, abdominal pain, and fever. Therefore, in young children presenting with clinical signs of obstruction of unknown etiology, there should be a high suspicion of possible unwitnessed water bead ingestion. Since water beads are radiolucent on X-ray, cross-sectional imaging is warranted, especially when there is concern for bowel obstruction.

3.4.3.1 | *Radiologic evaluation*

Many children presenting to the emergency room with suspected FB ingestion are asymptomatic. A chest radiograph with frontal and lateral views should be obtained, along with X-rays of the neck and abdomen, to avoid missing objects located above the thoracic

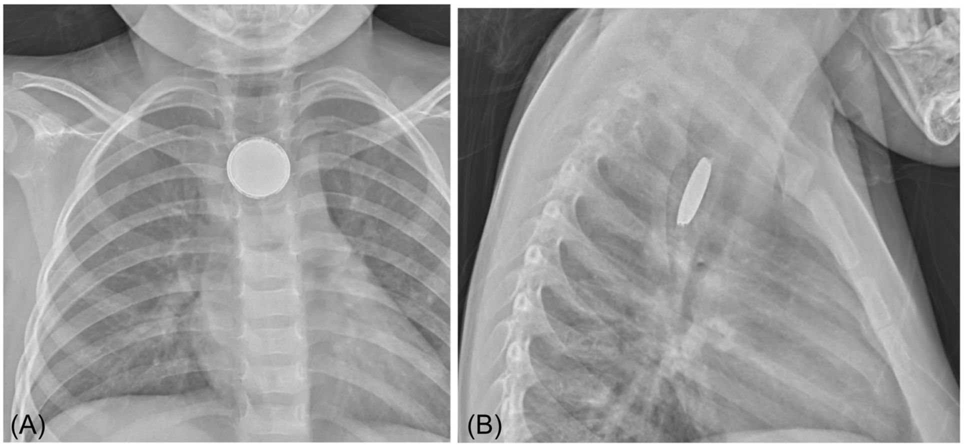


FIGURE 4 (A) Anteroposterior film of button battery's double rim or halo sign. (B) Lateral chest film button battery step-off sign. This sign indicates the difference in size between the two metallic disks that make up the battery.

inlet or distal to the stomach.[41] Coin ingestion is common and easily visible on X-ray, but BBs can resemble coins. Mistaking a BB for a coin can lead to severe complications. BBs are distinguishable on X-ray by their double ring or halo, which reflects their bilaminar structure see Figure 4.[42]

Radiolucent ingestions, such as food boluses, plastics, glass, water beads, or aluminum, are not easily seen on X-ray. Thin or sharp objects like pins or needles may also be difficult to visualize. In these cases, lateral films, CT scans, or esophagrams with water-soluble contrast can help. Signs of a radiolucent FB on a lateral X-ray include tracheal compression, tracheal deviation, or air trapped in the esophagus.[43] CT scans have been effectively used, such as in detecting plastic Lego toys with rapid, low-dose spiral CT scanning.[44]

Ultrasonography is generally ineffective for detecting FBs due to interference from bowel gas. However, point-of-care ultrasound may be useful for specific radiolucent objects, like superabsorbent water beads.[45]

Caution is necessary when considering a contrast study for FB ingestion. In symptomatic patients, contrast studies are contraindicated due to the risk of aspiration or leakage into the mediastinum. If radiologic imaging does not clearly identify the FB or its location in a symptomatic patient, diagnostic endoscopy is recommended for visualization and removal. When contrast studies are performed, water-soluble contrast should be used to reduce the risk of lung injury in case of aspiration.

3.4.4 | Caustic ingestion

Caustic ingestion commonly presents with symptoms such as drooling, vomiting, refusal of oral intake, and abdominal pain. Visible lesions, including erythema or ulceration of the lips and oral mucosa, may also be present. Hoarseness and stridor indicate upper airway or epiglottic involvement, while dysphagia and odynophagia suggest esophageal injury. Epigastric pain and bleeding are signs of stomach involvement.[46]

The relationship between symptoms and the severity of injury is unclear.[47] Studies attempting to correlate symptoms with the extent of gastrointestinal injury have produced mixed results. Crain et al. found that two or more symptoms, such as vomiting, drooling, or stridor, predicted serious esophageal injury.[47] Nuutinen et al. noted a correlation between drooling and dysphagia and esophageal injury.[48] Chen et al. suggested that three or more symptoms were associated with severe esophageal injury and stricture formation.[49]

However, other studies challenge these findings. Gaudreault et al. reviewed 378 pediatric cases and found that 12% of asymptomatic children had severe esophageal burns, while 82% of symptomatic children had no esophageal burns.[50] Dogan et al., in a study of 473 pediatric caustic ingestions (primarily alkaline), found esophageal lesions in 61% of patients without oral cavity burns, highlighting the poor correlation between oral and esophageal injuries.[51] Similar discordance has been reported in other studies.[52–54] Overall, the presence or absence of symptoms, including oral lesions, does not reliably predict the likelihood or severity of esophageal or gastrointestinal injury.

3.4.5 | Clinical assessment

A thorough history and physical examination are critical after caustic ingestion. The physical exam should include an airway assessment and inspection of the mouth for oral lesions. The history should identify the ingested material, its pH, estimated volume, and timing. Determining whether the ingestion was accidental or intentional is also essential, as intentional ingestions often involve larger volumes.

Complications of caustic ingestion include hemolysis, disseminated intravascular coagulation, renal failure, and liver failure. While laboratory tests can aid in management, they are not reliable predictors of outcomes. For example, Rigo et al. suggested that a white blood cell count over 20,000 cells/mm³ predicted mortality,[55] but later studies found no correlation between laboratory values like C-reactive protein or white blood cell count and injury severity or mortality.[56]

A chest radiograph may reveal mediastinal air (esophageal perforation) or free air under the diaphragm (gastric perforation). Upper gastrointestinal contrast studies are generally avoided acutely; if needed, water-soluble contrast is preferred to prevent complications from extraluminal leakage and to avoid interfering with subsequent endoscopy.

CT scans can evaluate transmural damage and necrosis in the esophagus and stomach and may predict injury severity or stricture risk better than endoscopy in some cases.[57–59]

Conservative observation may be appropriate for asymptomatic patients or those who ingested low-risk products without oral lesions.[60] Discharged patients require follow-up to monitor for complications and receive preventive guidance. Symptomatic patients or those with oral lesions should be hospitalized, kept NPO, started on IV fluids, and considered for endoscopy (discussed further in the endoscopy section).

4 | DISCUSSION

4.1 | Endoscopic management In ingestion cases

Effective management of ingestion cases requires assessing the need for intervention, determining urgency, and selecting the appropriate method. Table 2 outlines essential standards for endoscopic diagnosis and removal in cases of caustic ingestion, foreign bodies (FBs), and food impaction. Societal papers and or guidelines will be referenced when applicable.[38,61–67]

Endoscopic procedures must be performed by trained endoscopists with appropriate competencies who regularly update their knowledge through continued education.[68,69] A thorough pre-endoscopic evaluation, including a detailed history, physical exam, necessary radiographic assessments, and a safety checklist, is crucial to verify patient details and confirm informed consent. A standard flexible gastroscope is suitable for children over 1 year old or weighing more than 10 kg, while smaller scopes are recommended for children under 10 kg or when esophageal narrowing is suspected.

Endoscopy timing depends on patient-specific factors like age, weight, clinical presentation, and FB characteristics. Emergency interventions should adhere as best as possible to established timelines, though clinical scenarios may also dictate deviations based on the risks of immediate removal versus strict NPO timing. The following guidelines outline ingestion-specific timing recommendations for endoscopic intervention.

- Esophageal BBs: Emergent within 2 h (regardless of NPO status). During removal, tissue injury should be carefully assessed, and irrigation with 50–150 mL of 0.25% sterile acetic acid to neutralize the alkaline injury and mitigate injury. The only contraindication to acetic acid irrigation is if esophageal perforation is suspected.[25,38,64,66,70]
- Multiple high-power magnets: Within 6 h.[67]
- Sharp or high-lead-content objects: Within 24 h.[61,65]
- Food impactions: As soon as possible if causing obstruction or preventing secretion management.[61,65] Ideally, no FB or food bolus should remain in the esophagus for more than 24 h.[33,71]
- Caustic ingestion evaluation should occur within 12–48 h of ingestion.[62,64]
- Water beads: Although there is currently no consensus, multiple water beads in the stomach, similar to magnets, should be removed within 6 h. Solitary water beads may be managed conservatively; however, special considerations such as the potential expansion size of the bead, patient size, and history of prior abdominal surgery should be considered. If these factors indicate a higher risk, removal should be considered, particularly if the bead is reachable by endoscopy.

Diagnostic upper endoscopies are usually performed under sedation, preferably by a certified anesthesiologist. Anticipation of intubation needs is essential, particularly if the patient has not fasted for at least 8 h.[8,61,72] General anesthesia with endotracheal intubation is recommended for young children, complex or prolonged extractions, esophageal FBs, and cases involving supraglottic or epiglottic burns with erythema and edema.

If multiple magnets have passed beyond the stomach, push or balloon enteroscopy may be considered when the necessary equipment and expertise are available, provided there is no concern for bowel obstruction or fistula development. This approach may be particularly beneficial when multiple magnets were ingested within 24 h, before the risk of fistula formation increases.

Specialized equipment, including retrieval devices, overtubes, distal hoods, and transparent caps, can help protect the airway and esophageal mucosa when removing sharp or bulky FBs. However, some tools, such as esophageal overtubes with an outer diameter of 19.5 mm, may be too large for most pediatric patients and are generally more suitable for older adolescents.

TABLE 2 Minimal standards for endoscopic procedures related to pediatric ingestions.

Endoscopist expertise	
Requirement	Must have specific training and competencies related to endoscopic assessment and management of pediatric ingestions
Continued education	Regular updates and education are recommended to stay abreast of field advancements
Pre-endoscopic evaluation	
Evaluation components	Comprehensive evaluation including clinical history, physical examination, and, if necessary, radiographic assessment
Safety checklist:	Usage of a pre-endoscopy checklist that includes verification of patient identifiers, allergies, medications, comorbidities, and consent
Timing of endoscopy	
Emergency cases	Immediate removal of esophageal button batteries within 2 h and high-power magnets within 6 h.
Urgent cases	Address sharp objects, or high lead content items within 24 h.
General guidance	No foreign body or food bolus should remain in the esophagus for more than 24 h.
Pediatric caustic ingestion	
Role of endoscopy	Crucial for diagnosis and severity assessment in accidental ingestions
Timing	Recommended within 12–48 h if indicated; avoid endoscopy between 3 and 15 days after ingestion due to perforation risks
Button battery	
Postremoval	Meticulous evaluation for tissue injury is required
If no visible perforation	Consider endoscopic irrigation with 50–150 mL 0.25% sterile acetic acid
Airway protection, sedation, and anesthesia	
Sedation	Typically conducted under sedation, administered by a certified anesthesiologist
General anesthesia	Recommended for: • Young children • Patients not properly fasted • Cases involving multiple foreign bodies • Esophageal foreign bodies and food impaction • Anticipated difficult and/or lengthy extractions • Evidence of supraglottic or epiglottic burns with erythema and edema
Equipment	
Standard scope	Suitable for children over 1 year or weighing more than 10 kg
Smaller scopes and devices	Consideration for smaller scopes and various retrieval devices based on the size of the patient and the foreign body

Endoscopy is critical for diagnosing and evaluating caustic agent ingestion injuries, with timing guided by symptoms and the ingested substance. Asymptomatic cases may not require immediate endoscopy. When indicated, endoscopy should occur within 12–48 h of ingestion, minimizing perforation risk by limiting air insufflation and using CO_2 if available. The procedure should be stopped if perforation is suspected. Endoscopy is typically contraindicated 3–15 days post-ingestion due to the high perforation risk, particularly in hemodynamically unstable patients or those with respiratory distress.[64,73] Acetic acid irrigation may be beneficial for alkaline injuries other that BBs but requires further validation.

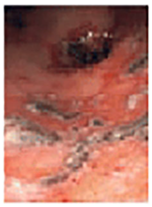
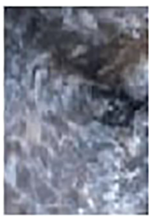
4.2 | Postprocedural and postingestion care

Postcare management depends on the FB type, location, duration of ingestion, mucosal injury, and endoscopic findings.

When an FB is successfully removed without mucosal injury, patients can typically resume a regular diet as tolerated and be discharged.[61,72] For cases involving mucosal injury, particularly in the esophagus, a cautious approach is required, which may include:

- A 24-h observation period to monitor for perforation or bleeding.

TABLE 3 Grading of caustic ingestion injury based on endoscopic findings.

Grade	Description	Endoscopy image
Grade I	Edema and hyperemia of the mucosa	
Grade IIa	Superficial localized ulcerations, friability, and blisters	
Grade IIb	Circumferential and deep ulcerations	
Grade IIIa	Multiple and deep ulcerations and small scattered areas of necrosis	
Grade IIIb	Extensive necrosis	

Note: Table from Cabral et al.[89].

- Admission with the patient kept NPO.
- Fluoroscopic imaging, if necessary.

If an esophagogram reveals no abnormalities, the patient can start on a clear liquid diet, progressing as tolerated based on clinical recovery.

4.3 | Unretrieved FBs

Most FBs pass through the gastrointestinal tract without complications.[61,73,74] In asymptomatic cases involving coins, round objects, or single magnets, a conservative outpatient approach is appropriate. This includes routine stool checks to monitor for object passage and follow-up radiographs every 1–2 weeks if passage has not been observed.[75,76] While most FBs pass within 4–6 days, some may take up to a month.[77] Laxatives may be used to expedite passage, but evidence supporting their effectiveness is limited. Once the object has passed, additional imaging is usually unnecessary.[78,79]

If there is concern for obstruction or perforation, such as with water beads, long, or sharp objects, admission may be required. Management in these cases may include serial X-rays for radiopaque objects and consultation with a surgeon.[61,73,77,80,81] The length of hospital stay depends on the severity of the situation. Patients who ingest superabsorbent water beads and exhibit signs of partial obstruction should undergo immediate surgical consultation to assess the need for removal, given the high risk of complete obstruction and perforation.

4.4 | High-risk ingestion situations: Button batteries, multiple magnets, and caustic ingestions

For BB ingestions, management depends on the severity of the injury. If endoscopy reveals minimal or no mucosal injury and the patient is asymptomatic, resuming a regular diet is considered safe. When esophageal mucosal injury is detected, a minimum 24-h inpatient observation is recommended with the patient kept NPO.

Post-removal care includes initiating empiric antibiotics and proton pump inhibitors (PPIs) to protect the mucosa. Cross-sectional imaging, such as magnetic resonance imaging/magnetic resonance angiography or computed tomography angiography of the neck and chest, should be performed within 24–48 h to assess for vascular injuries.[61,63,66,67,70] These cases require management at facilities with cardiothoracic surgery expertise. Before oral feeding is resumed, a water-soluble esophagram is advised to evaluate for perforation.[61,83,84] Acute and delayed complications of BB ingestion include perforation, mediastinitis, fistulas (e.g., aorto-esophageal or tracheo-esophageal), strictures, vocal cord paralysis, and spondylodiscitis. Follow-up upper endoscopy is recommended 3–4 weeks after ingestion to assess healing, particularly for significant injuries. Circumferential injuries or injuries involving opposing surfaces require closer monitoring due to an increased risk of stricture formation.[70,82,83]

In cases involving multiple magnets or a magnet with a metallic object, the risk of severe gastrointestinal injury, including ischemia, necrosis, fistula formation, perforation, obstruction, and volvulus, is significant.[61,67,84,85] Urgent endoscopic removal is required when magnets are accessible in the gastrointestinal tract.[61,64,67] If removal is not feasible, the patient should be admitted for observation and closely monitored, with early surgical consultation. Clinical and radiological follow-up is necessary to track the magnets' progression andto detect signs of complications, requiring close collaboration with surgical teams.[61,64,67,85,86]

For caustic ingestions, post-procedural care depends on the severity of mucosal injury, as classified by the Zargar system[87,88] (See Table 3). Grade 0 and I injuries typically require no further therapy, and early feeding can be initiated. For Grade II and III injuries, PPIs at 0.7–3.5 mg/kg/day for 2–3 weeks have been reported to reduce complications.[63,64,90,91] Antibiotics are indicated in cases of infection, peritonitis, mediastinitis, or full-thickness injuries due to the high risk of perforation.[63,64,90,91] For Grade IIa lesions, a semiliquid diet may be initiated after 72 h of observation. Nasogastric feeding may be considered for Grade IIb or III injuries, especially when there is a high concern for perforation and the risk of later stricture development. Total parenteral nutrition or postpyloric feeds should be used if esophageal perforation is suspected.[63,64,87,88,90,91] Careful monitoring and tailored therapy are crucial to address complications, ensure nutritional adequacy, and support recovery.

4.5 | Prevention

This report highlights the urgent need for improved preventive measures and standardized management guidelines to reduce the incidence of pediatric ingestions and improve outcomes globally. FB ingestion can result in devastating complications, placing a heavy burden on patients and healthcare systems. As such, prevention is a critical public health priority.

Public health programs, such as Reese's Law in the United States, which mandates federal safety requirements for Bs, have demonstrated success in reducing the incidence of BB, magnet, and caustic ingestions. However, implementation of these measures remains inadequate in many regions. Legislation, combined with public awareness and education, is key to preventing the severe outcomes associated with such ingestions.

TABLE 4 Preventive measures for foreign body ingestion.

Button battery	Warning labels Screw-secured battery compartment Individual packaging Child-resistant packaging Bitter coating
Magnets	Warning labels prohibiting the use and marketing of high-powered magnets in children's toy Child-resistant packaging
Caustic ingestion	Safety bottle cap Crystal rather than liquid forms of corrosive agents Warning labels Child-resistant packaging

Table 4 outlines reported preventive methods for FBs that pose serious consequences. Child-resistant packaging, such as screw-secured compartments for electronic devices and individual packaging for BBs, has proven effective in limiting access by infants and toddlers.[40,67,92,93] Despite these measures, BBs remain a significant ingestion risk due to their widespread use in toys and devices that often lack secure compartments.[40,92] The use of household drinking bottles and containers to store caustic cleaning products remains common. Educating caregivers and the public about the dangers of this practice can help reduce its occurrence. Safety bottle caps and crystalline formulations, instead of liquids, can help prevent caustic chemical ingestions.[62,67,87,92,94,95] Lower-income households face higher risks of FB ingestion, emphasizing the need for universal legislation to ensure protective measures are implemented across all socioeconomic levels.[15,96]

Public awareness campaigns are vital in educating parents, caregivers, industries, schools, healthcare professionals, and the media about the dangers of FB and caustic ingestion.[67,95] Legislative action and enforcement also play a critical role. For example, countries such as Australia, Canada, Japan, and New Zealand have instituted bans or regulations on high-powered magnets sold as toys.[92–94] Although the United States initially banned these magnets, the prohibition was later overturned, leading to a surge in ingestions. Subsequently, new regulations were reinstated, underscoring the importance of robust enforcement mechanisms. Comparative analyses of regulatory successes can guide broader adoption and enforcement.

There is a paucity of data on prevention measures in developing countries and or economically disadvantaged areas. From the limited epidemiology studies published we know that this population of children are highly at risk.[15–20] Further investigation on how best to implement preventive measures based on socioeconomic status and regional infrastructure would be critical. Research and innovation are also essential in reducing the risks associated with FB ingestions. Emerging technologies, such as quantum tunneling composite coatings (QTCC), show promise in mitigating the hazards of BB ingestion. QTCC is a waterproof, pressure-sensitive coating that remains nonconductive in fluid environments but allows normal battery function when pressed within a device. By preventing external current flow, QTCC reduces the risk of electrolysis and tissue injury associated with BB ingestion. When immersed in a simulated intestinal environment, QTCC-coated BBs do not produce electrolysis or release harmful contents, effectively preventing the primary mechanisms of injury.[39,96] Continued investment in these advancements will be critical in further enhancing prevention efforts worldwide.

5 | CONCLUSIONS

This FISPGHAN report emphasizes the significant health risks of pediatric FB and caustic substance ingestions, highlighting global variations in epidemiology and management. It underscores the urgent need for improved prevention through public health initiatives, legislation, and education. Establishing uniform management guidelines is essential to enhance outcomes for affected children worldwide. This collaborative effort provides a framework for healthcare providers to improve practices, reduce the incidence of ingestions, and minimize associated complications.

AFFILIATIONS

[1]Division of Gastroenterology, Hepatology, and Nutrition, Childrens Hospital of Philadelphia, University of Pennsylvania School of Medicine, Philadelphia, Pennsylvania, USA

[2]Razetti Healthcare Services LLC - IDB Medical Group, Barquisimeto, Venezuela

[3]National Center for Child Health and Development, Division of Gastroenterology, Setagaya, Japan

[4]University of Child Health Sciences and Children's Hospital Lahore, Lahore, Pakistan

[5]Department of Child Health, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia

[6]Sidra Medicine, Qatar University and Weil Cornell Medicine, Doha, Qatar

[7]Division of Gastroenterology and Endoscopy, Centro Hospitalario Pereira Rossell, University República Oriental del Uruguay, Montevideo, Uruguay

[8]Department of Gastroenterology, Hepatology and Nutrition, University Children's Hospital, University of Ljubljana, Ljubljana, Slovenia

[9]Pediatric Gastroenterology Unit, Department of Pediatrics, King Abdulaziz University, Jeddah, Saudi Arabia

[10]Division of Gastroenterology, Hepatology, and Nutrition and the SickKids Research and Learning Institutes, The Hospital for Sick Children, University of Toronto, Toronto, Ontario, Canada

[11]Department of Pediatric Gastroenterology, Erasmus MC - Sophia Children's Hospital, University Medical Center, Rotterdam, the Netherlands

CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

ORCID

Michael A. Manfredi https://orcid.org/0000-0002-0173-1441

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