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Foreign body ingestion in children: impact of a digital app on clinical decision-making

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Abstract

Background

Foreign Body Ingestion (FBI) is a common reason for paediatric Emergency Department (ED) visits. Although most cases resolve spontaneously, a significant proportion requires urgent intervention. Adherence to standardised, evidence-based protocols is essential to prevent complications and ensure appropriate care.

Methods

This retrospective, single-centre study analysed all paediatric FBI cases over a four-year period. Demographic, clinical, and management data were retrieved and compared with international guidelines and recommendations from the *Corpi Estranei* mobile application, a digital decision-support tool derived from North American Society for Paediatric Gastroenterology, Hepatology and Nutrition (NASPGHAN) and European Society for Gastroenterology, Hepatology and Nutrition (ESPGHAN) protocols.

Results

A total of 475 confirmed cases were identified (59.6% males). Most patients were aged 2–5 years (50.3%), and blunt objects were the most frequently ingested items (82.5%). Most children were asymptomatic (72.6%), while 26% required hospitalisation. Among admitted patients, 64.7% underwent endoscopic or surgical intervention. Interhospital transfers significantly increased hospitalisation rates; however, 37% of transfers were potentially avoidable. Fifteen cases (3.2%) deviated from guideline-based management, mainly due to unnecessary or delayed procedures or omitted imaging, most of which involved transferred patients ($p < 0.05$).

Conclusions

Management of paediatric FBI remains heterogeneous, with frequent deviations from recommended protocols and a notable rate of avoidable transfers and procedures. This study suggests that structured decision-support algorithms may help reduce avoidable transfers and improve guideline adherence in regional paediatric networks.

Introduction

Foreign Body Ingestion (FBI) is a common paediatric emergency, particularly in young children. Although most cases resolve spontaneously, the type, location, and timing of ingestion may necessitate urgent intervention to prevent serious complications¹⁻³. Foreign bodies are most often blunt objects, followed by sharp or absorbent materials, food boluses, button batteries, and magnets⁴. Most affected children are asymptomatic, and fewer than one in four present with any symptom⁵⁻⁷. When symptoms occur, they are often vague, but their nature and number are strongly associated with the need for intervention.

The object's type, site, and duration of the impaction determine the clinical scenario^{9,10}. Timely diagnosis and evidence-based management are essential to prevent severe or fatal outcomes. Given the complexity of these cases, a multidisciplinary approach supported by digital tools can enhance adherence to guidelines and promote standardised management, especially in centres with limited paediatric experience.

Adherence to validated protocols helps reduce morbidity, and healthcare costs, and decision delays. Tools such as the Italian Society for Paediatric Gastroenterology, Hepatology and Nutrition (SIGENP) nomogram, which predicts the need for intervention based on clinical and object characteristics⁹ and the Foreign body (*Corpi Estranei*) App, derived from the North American Society For Paediatric Gastroenterology, Hepatology And Nutrition (NASPGHAN) and European Society For Gastroenterology, Hepatology and Nutrition (ESPGHAN) guidelines, exemplify this innovation¹¹. However, real-world adherence to guideline-based management and referral pathways in paediatric foreign body ingestion remains insufficiently described.

This study aims to describe the epidemiology of the FBI in a tertiary paediatric hospital over four-years and to assess the concordance between local management and international guidelines. It also explores how emerging digital tools may improve the efficiency and accuracy of clinical decision-making.

Materials and methods

This single-centre, retrospective, observational study included all cases of paediatric FBI admitted to the emergency department of a tertiary paediatric hospital in central Italy over a four-year period.

Demographic and clinical data were retrieved from the digital archives and software applications of our centre. The collected cases were compiled into an excel based database, and analysed with *StataNow 18 SE*. As the study used retrospective, anonymized data, ethical approval was not required in accordance with institutional and national regulations.

A screening of the emergency department records, to identify FBI between the 1st of August 2020 and the 30th of September 2024, using the following ICD-9-CM discharge codes¹² 9351 (Foreign body in oesophagus), 9352 (Foreign body in stomach), 936 (Foreign body in small and large intestine), and 938 (Foreign body in digestive system, site unspecified) yielded 502 cases: 86 oesophageal, 223 gastric, 72 intestinal, and 121 unspecified. Each case was reviewed manually to confirm an actual diagnosis of FBI, resulting in the exclusion of 27 episodes (Figure 1). The final dataset comprised 475 confirmed cases, which were entered into the study database.

A second database was created to assess adherence to evidence-based management protocols. Each diagnostic and therapeutic pathway was compared with recommendations from the *Corpi Estranei* mobile application, derived from ESPGHAN and NASPGHAN guidelines. The App operationalises current NASPGHAN/ESPGHAN recommendations. Cases were categorized according to outcome (hospitalisation and intervention) and guideline concordance. Guideline adherence was classified as either a full match (management aligned with recommendations) or intervention mismatch (unnecessary or omitted intervention according to the App-based algorithm). Moreover, interhospital transfers were

independently classified as potentially avoidable transfer, defined as inter-hospital transfers not followed by specialist evaluation or therapeutic intervention (endoscopic or surgical) at the referral centre, or non-potentially avoidable transfers. Potentially avoidable transfers and deviations from guideline-based recommendations were analysed as distinct and non-overlapping outcomes and were not considered synonymous. Classification was independently performed by an experienced paediatric emergency department physician, with assistance from a medical student, using the App's criteria. Cases were considered discordant when, according to the App flowchart, the child could have been safely discharged or briefly observed rather than admitted or transferred.

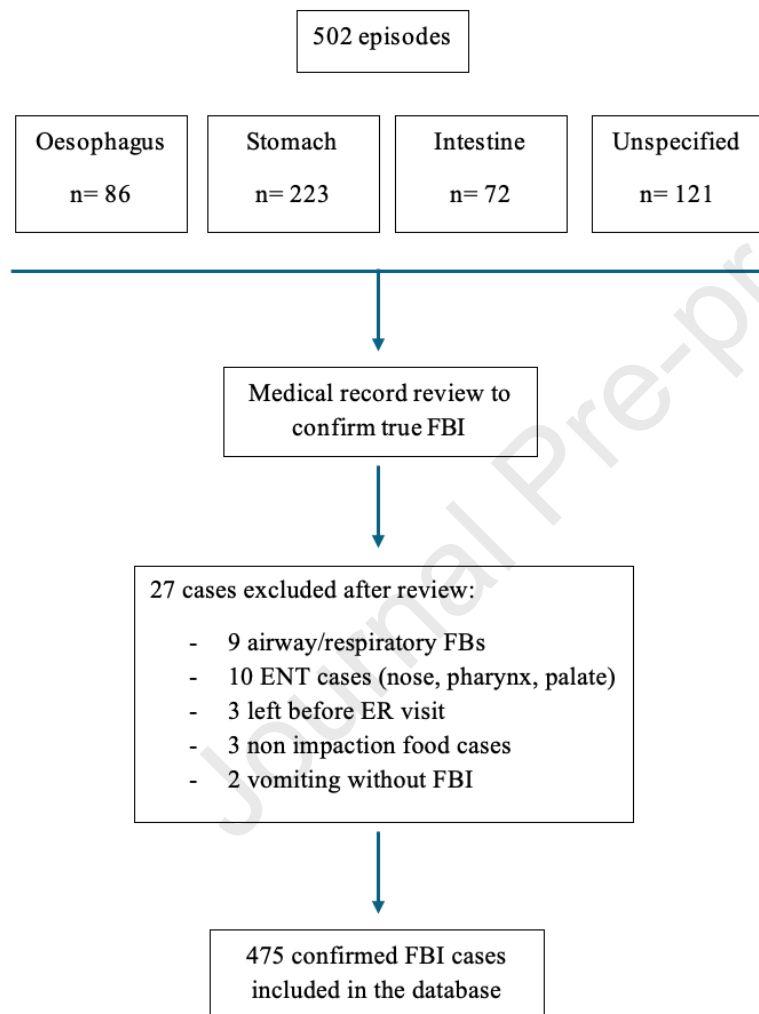


Figure 1. Screening process for patients' inclusion. FB: foreign body, ENT: ear, nose and throat, ER: emergency room, FBI: foreign body ingestion.

Results

Patient characteristics

A total of 475 paediatric FBI cases were identified over the four-year period, comprising 192 females (40.4%) and 283 males (59.6%). One-year-old children represented the largest age group (75/475, 15.8%), followed by those aged 3 and 4 years (Figure 2).

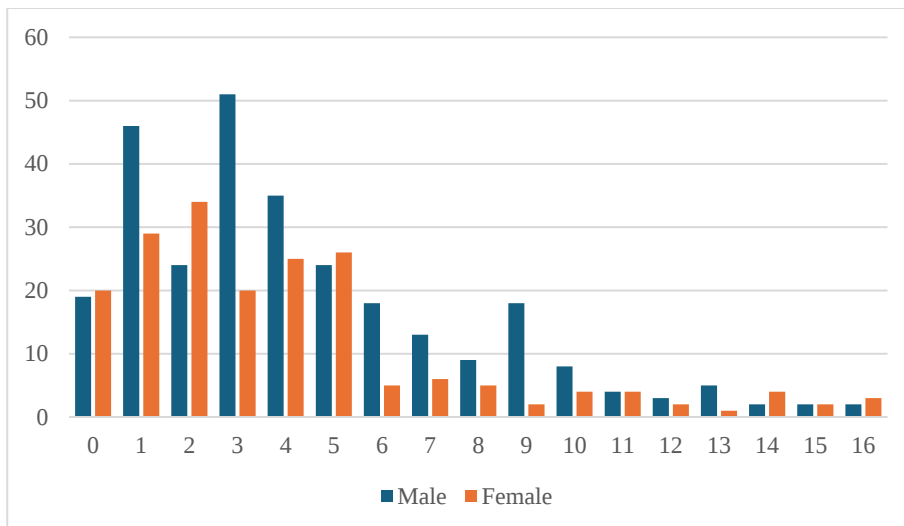


Figure 2 - Age and Sex Distribution

Blunt objects were the most frequently ingested (392/475, 82.5%), followed by button batteries (45/475, 9.5%) (Figure 3). Most children were asymptomatic (345/475, 72.6%), while 130/475 (27.4%) presented with at least one symptom, most commonly sialorrhea and vomiting (36 each), followed by abdominal pain and pharyngodynia. No significant association was found between age and outcome ($p = 0.13$). However, younger children (< 5 years) were less likely to be symptomatic after ingestion compared with older ones ($OR = 0.47$, 95% CI: 0.30–0.72, $p < 0.005$) and button battery ingestion appeared to be significantly more frequent in children younger than 5 years than older children (43/353 vs. 2/122; $OR = 8.32$, 95% CI: 1.99–34.7, $p < 0.05$).

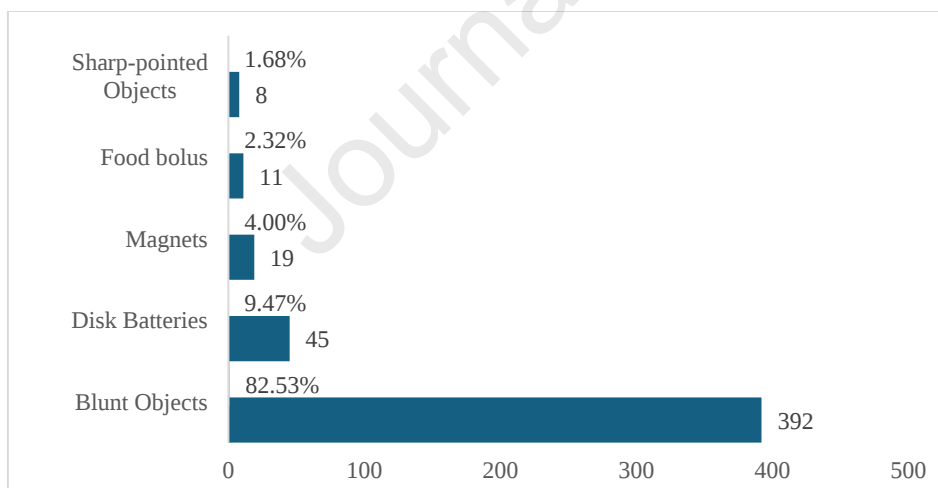


Figure 3 - Foreign Body Type

Management and clinical outcomes

Overall, 353/475 patients (74%) were discharged after evaluation. The remaining 122/475 patients (26%) were admitted: 41 (33.6%) received conservative management and 81 (66.4%) underwent operative intervention (figure 4). One patient required admission after discharge and later surgical intervention following unsuccessful endoscopic removal. A total of 82/475 patients underwent either endoscopy ($n = 79$) or surgical intervention ($n = 3$).

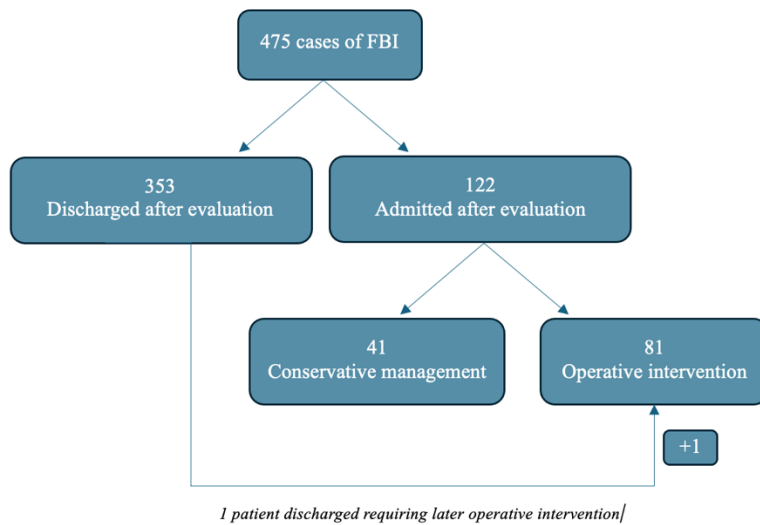


Figure 4. Management of FBI patients.

Among these, 52/82 had an oesophageal foreign body and underwent endoscopic removal. Twenty-five had a gastric foreign body; in four of these cases, endoscopy was performed for small blunt objects that had already migrated distally at the time of the procedure. The remaining gastric cases involved sharp objects, large foreign bodies (>2.5 cm in diameter or >6 cm in length), button batteries, or complex foreign material requiring active removal. Four additional patients had a foreign body located beyond the stomach at presentation but underwent endoscopy anyway. One further case involved a radiolucent foreign body with uncertain localization. Figure 5 summarizes reasons and results of operative management.

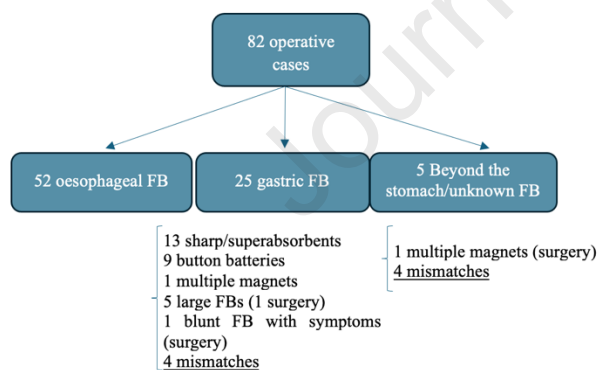


Figure 5. Reasons and results of operative management.

The three patients who required surgical intervention presented with distinct clinical scenarios.

The first was a 10-year-old boy who had ingested multiple magnets, which were found beyond the stomach on imaging. Although initially asymptomatic, surgical intervention was undertaken due to the high risk of bowel entrapment and perforation. Intraoperative findings showed an intestinal fistula due to the presence of the magnets with necessity of surgical resection and primary anastomosis.

The second case involved a 12-year-old girl with a history of pica who had ingested multiple non-edible materials, resulting in the formation of a large gastric and duodenal bezoar composed of hair, ice-cream sticks, adhesive tape, and other plastic fragments. She presented with epigastric pain and vomiting. Endoscopic evaluation revealed diffuse

duodenal mucosal ulcerations associated with the bezoar. Given the size, extension, and mucosal involvement, surgical removal was required.

The third patient was a 15-year-old girl with a history of an eating disorder who had ingested a toothbrush while attempting to induce vomiting. The foreign body was in the stomach and was not amenable to endoscopic retrieval, thus necessitating surgical removal.

Interhospital transfers

A total of 106/475 patients (22.3%) were transferred from peripheral hospitals. Transferred patients had markedly higher odds of hospitalization across all paediatric age groups (<1 year OR = 9.47, 95% CI: 3.46–26.0, $\chi^2 = 22.85$, $p < 0.0001$, 2–5 years OR = 8.05, 95% CI: 4.17–15.7, $\chi^2 = 44.88$, $p < 0.0001$, 6–16 years OR = 6.31, 95% CI: 2.27–17.5, $\chi^2 = 14.63$, $p < 0.001$). Transfer also correlated with increased hospitalization for most foreign body types, particularly non-harmful objects (OR = 7.17, 95% CI: 4.05–12.7, $p < 0.0001$), magnets (OR = 52, 95% CI: 2.61–1030, $p = 0.0015$, the wide confidence interval reflects the small sample size.), and gastric foreign bodies (OR = 10.0, 95% CI: 4.43–22.6, $p < 0.0001$). (Table 1). In contrast, foreign bodies beyond the stomach, were less likely to lead to admission when patients were transferred (OR = 0.052, 95% CI: 0.006–0.44, $p = 0.01$).

Table 1. Association between inter-hospital transfer and hospital admission by age group and foreign body type.

Category	OR (95% CI)	p-value
Age group		
<1 year	9.47 (3.46–26.00)	<0.0001
2–5 years	8.05 (4.17–15.70)	<0.0001
6–16 years	6.31 (2.27–17.50)	<0.001
Foreign body type		
Non-harmful objects	7.17 (4.05–12.70)	<0.0001
Magnets	52 (2.61–1030)	0.0015
Button batteries	Not significant	–
Oesophageal foreign bodies	Not significant	–
Gastric foreign bodies	10.00 (4.43–22.60)	<0.0001
Beyond the stomach	0.05 (0.006–0.44)	0.01

Among 106 interhospital transfers, 39 cases (37%) were considered potentially avoidable. Most involved ingestion of blunt objects, while only 3 concerned button batteries, two of which already beyond the stomach on imaging. Of these 39/106 cases, 24/39 (61%) were discharged from the ED, and 15/39 (39%) were hospitalized - a significantly lower rate than for non-avoidable transfers (72%).

Guideline adherence and deviations from the Corpi Estranei App

Reviewing all clinical records, 15/475 cases (3.2%) deviated from the *Corpi Estranei* App recommendations. These cases involved seven infants, three children aged 2–5 years, and five older children, who had ingested 11 blunt foreign bodies, 2 multiple magnets, and 2 disk batteries. Eight of these 15 cases were transferred patients, and four were also classified as potentially avoidable transfers.

In six cases, endoscopic removal was indicated according to guideline-based recommendations but was not performed. Two of these cases resulted in major adverse outcomes, including one transfer to a referral centre with cardiovascular expertise and one surgical bowel resection following multiple magnets ingestion. Reasons for omitted endoscopy were

not specified in most cases, when reported they appeared related to delayed referral, incorrect clinical judgement or clinical underestimation.

In one case, endoscopy was not indicated; however, according to the App, the patient should have been admitted for observation due to a sharp foreign body located beyond the stomach requiring radiological monitoring.

Conversely, in eight cases, unnecessary endoscopy (including one bronchoscopy) was performed; in four of these, no foreign body was retrieved as it had already progressed beyond the duodenum. Only one minor procedural complication was recorded (gastric mucosal bruise at another hospital). In several instances, repeat radiographic evaluation prior to intervention might have reduced the likelihood of unnecessary procedures.

Discussion

This study summarises the epidemiology, management, and outcomes of paediatric FBIs over a four-year period in a tertiary referral centre. The findings underscore the importance of a protocol-driven approach, as management in non-paediatric or low-volume settings often relies on individual experience rather than established guidelines, leading to variability in care and outcomes. Promoting adherence to standardised protocols, supported by digital decision-support tools, may improve diagnostic accuracy and therapeutic consistency¹¹.

The demographic profile of our cohort aligns with previous studies: children under five years remain the highest-risk group^{4,13,14}, and coins and other blunt objects predominate, reflecting their domestic availability¹⁵. In contrast, button batteries, increasingly common due to the proliferation of small electronic devices, pose a higher risk of intervention and complications^{16,17}.

Our results show that transferred patients across all age groups and foreign body types had significantly higher odds of hospitalisation, suggesting that peripheral centres generally identify and refer higher-risk patients appropriately. However, 37% of interhospital transfers were considered potentially avoidable, as these patients ultimately did not require specialist evaluation or therapeutic intervention (endoscopic or surgical). Furthermore, the admission rate among potentially avoidable transfers (39%) was substantially lower than among other transfers (72%), indicating that structured decision-support tools may help optimise triage and referral pathways. Some of the estimated odds ratios should be interpreted cautiously, as the wide confidence intervals likely reflect the relatively small number of cases in certain subgroups.

Our institution operates within a mixed referral model. It serves as the main regional paediatric referral centre (hub) while also directly admitting patients from the local catchment area, thereby functioning in part as a spoke. In addition, multiple peripheral hospitals in the region lack dedicated paediatric services and initially evaluate paediatric patients with suspected foreign body ingestion before referring them to our centre. Decisions regarding hospital admission and interhospital transfer are not centralised and may vary across institutions. Peripheral emergency department physicians, paediatricians, or adult surgeons may independently decide to transfer patients. In some cases, telephone consultation with our specialists is sought; however, the final decision to transfer remains with the referring clinician. The criteria guiding these decisions are not standardised and are frequently influenced by local resource availability. Limited access to paediatric expertise, endoscopic services, or specialised personnel in peripheral centres often leads to transfer for precautionary reasons, even in the absence of clear clinical indications for higher-level care. No formal regional referral protocol for suspected FBI currently exists. In this setting, a digital decision-support tool such as the *Corpi Estranei* App may help bridge these gaps by offering real-time, guideline-based support, particularly in non-specialist hospitals. The App represents one example of how guideline-based algorithms can be translated into point-of-care decision support.

The *Corpi Estranei* App may support clinicians involved in the early management of children with suspected foreign body ingestion across different levels of care, including emergency physicians, paediatricians, surgeons, and general practitioners. In non-specialist hospitals, where paediatric expertise and endoscopic services may be limited, the App may assist in distinguishing patients who can be safely managed locally from those requiring referral to a tertiary paediatric centre, potentially reducing avoidable interhospital transfers while ensuring timely escalation of high-risk cases. In tertiary centres, it may also facilitate rapid access to guideline-based recommendations and promote more consistent clinical decision-making.

Guideline adherence in our cohort was high overall, with only 3.2% of cases classified as intervention mismatch according to the App-based algorithm. These deviations included both omitted indicated interventions and unnecessary procedures. In a small number of cases, failure to perform endoscopy despite guideline indication resulted in clinically significant consequences. Reasons for omitted procedures were not always available due to the retrospective nature of the study; however, deviation from guidelines often derived from delayed referral or underestimation of symptoms and presentation. Conversely, unnecessary procedures were occasionally performed in situations where conservative management or repeat imaging may have been sufficient. These findings highlight opportunities to optimise imaging strategies and procedural timing.

Although surgical intervention was required in only a small proportion of cases in our cohort (0.6%), the clinical scenarios observed highlight the importance of early identification of high-risk ingestions. Multiple magnet ingestion and large or complex gastric foreign bodies may rapidly lead to severe complications such as bowel entrapment, fistula formation, or obstruction when diagnosis or intervention is delayed. These findings reinforce the need for timely recognition of high-risk cases and appropriate referral to centres with paediatric surgical and endoscopic expertise.

From a healthcare system perspective, reducing unnecessary transfers and procedures may also have relevant economic implications. In the Italian healthcare system, a paediatric day admission may cost approximately €500, while an endoscopic procedure under general anaesthesia may exceed €2000..^{20,20–23}. Even conservative estimates therefore suggest that avoiding the 39 potentially avoidable transfers and the small number of unnecessary procedures observed in our cohort could translate into meaningful cost savings, in addition to reducing anaesthesia exposure and hospital utilisation.

This study has several limitations. First, its retrospective and single-centre design may introduce selection and information bias and limit the generalisability of the findings to other healthcare settings. Second, the retrospective reconstruction of clinical pathways from electronic medical records may have resulted in incomplete documentation or misclassification of management decisions. In particular, the use of the *Corpi Estranei* application as a proxy for NASPGHAN/ESPGHAN guideline recommendations may not capture all clinical nuances, potentially leading to guideline misclassification in a small number of cases. In addition, referral patterns may have introduced referral bias, as more complex or higher-risk patients are more likely to be transferred to tertiary centres. Finally, long-term outcomes and detailed cost data were not available, limiting a more precise evaluation of the clinical and economic impact of management strategies.

Despite these limitations, our data highlight the value of structured, multidisciplinary management supported by digital decision systems. Deviation from guideline-based management may stem from limited familiarity with paediatric specific protocols, which can be mitigated through App-based, evidence-guided tools. Integrating such tools into hub-and-spoke care models could empower community hospitals to manage low-risk cases locally, while ensuring timely referral of complex cases.

A stepwise implementation strategy could enhance adoption. First, introduce the App as an optional triage aid in emergency department workflows. Second, provide brief, case-based training for emergency and paediatric teams. Third,

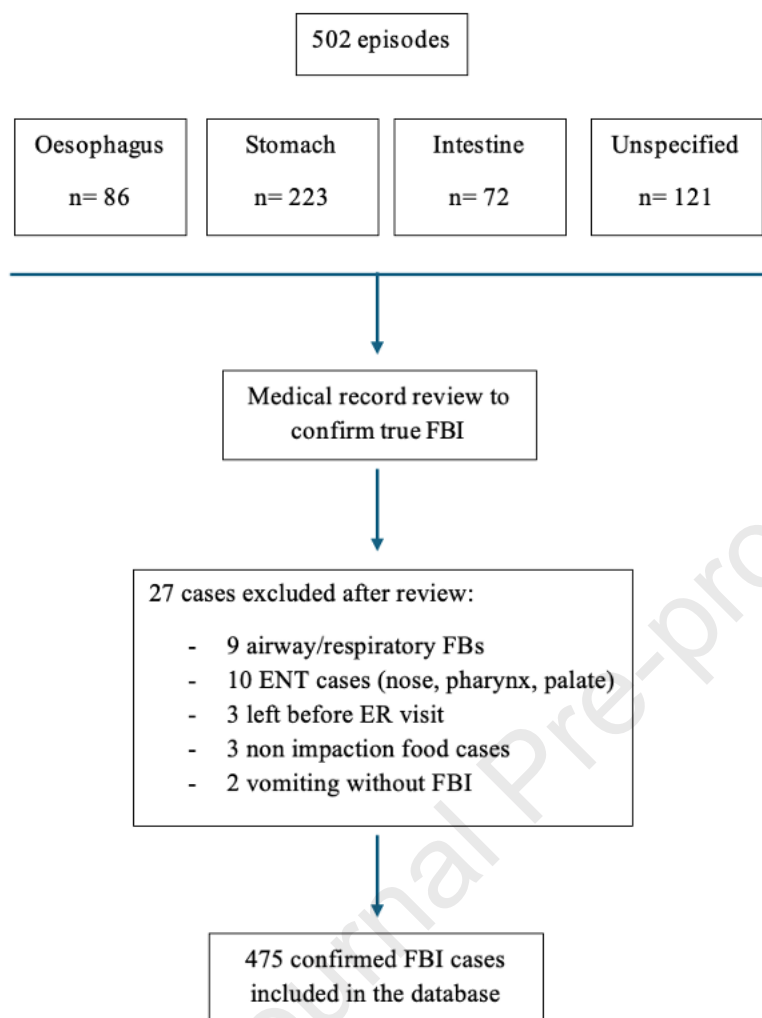
prospectively audit adherence to recommendations and process indicators, such as radiography before endoscopy and intervention timing. This approach would allow progressive integration while generating data necessary for a formal evaluation. Beyond its descriptive findings, this study has prompted reflection on the need to strengthen shared clinical pathways within our regional network. Based on these results, targeted educational initiatives are being planned for community paediatricians and physicians working in peripheral emergency departments, with the aim of discussing the management of suspected foreign body ingestion, disseminating the most recent guideline recommendations, and promoting a more standardised and shared referral protocol. These initiatives may also represent an opportunity to encourage the use of digital decision-support tools, such as the *Corpi Estranei* App, to facilitate guideline-based management and improve coordination between peripheral centres and the tertiary referral hospital.

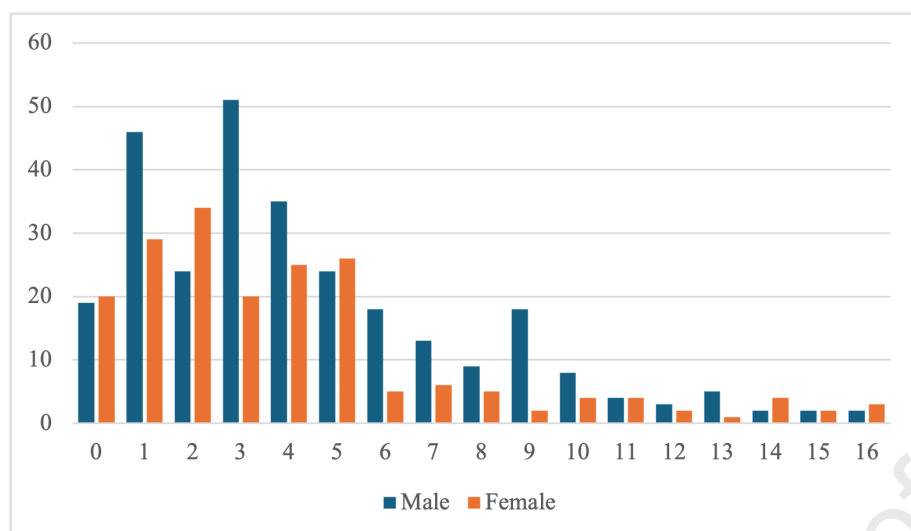
Conclusions

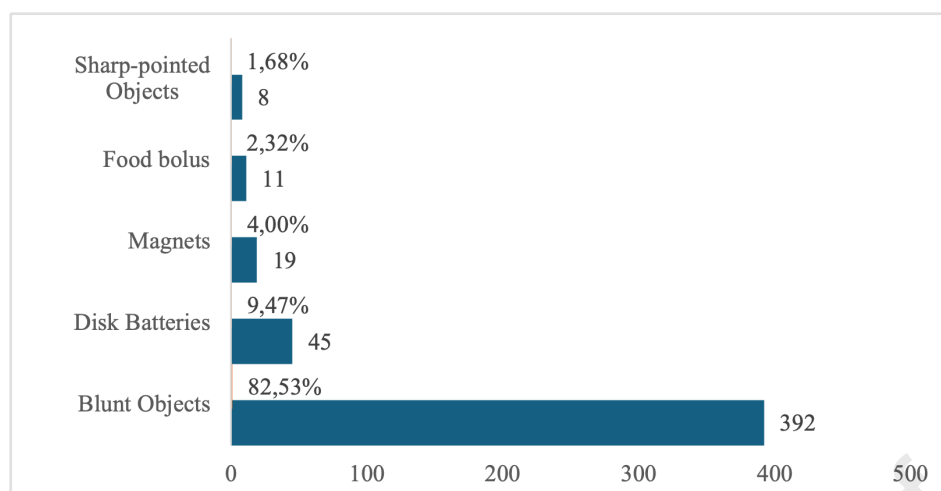
Paediatric foreign body ingestion continues to be managed heterogeneously, despite the availability of well-established clinical guidelines. In this cohort, a small but clinically meaningful proportion of transfers and procedures was potentially avoidable, highlighting persistent gaps in guideline implementation and referral standardisation. Our findings highlight how regional paediatric surgical hubs can support peripheral hospitals not only through referral but also through shared decision-support tools and structured communication pathways. Integrating structured, guideline-based decision-support algorithms into regional care networks may improve triage accuracy, reduce unnecessary transfers and interventions, and ultimately enhance the safety and efficiency of paediatric emergency care.

References

1. Jayachandra S, Eslick GD. A systematic review of paediatric foreign body ingestion: Presentation, complications, and management. *Int J Pediatr Otorhinolaryngol*. 2013;77(3):311-317. doi:10.1016/j.ijporl.2012.11.025
2. Romero BM, Vilchez-Bravo S, Hernández-Arriaga G, et al. Factors associated with complications of foreign body ingestion and/or aspiration in children from a Peruvian hospital. *Heliyon*. 2023;9(2):e13450. doi:10.1016/j.heliyon.2023.e13450
3. Denney W, Ahmad N, Dillard B, Nowicki MJ. Children Will Eat the Strangest Things: A 10-Year Retrospective Analysis of Foreign Body and Caustic Ingestions From a Single Academic Center. *Pediatr Emerg Care*. 2012;28(8):731-734. doi:10.1097/PEC.0b013e31826248eb
4. Khorana J, Tantivit Y, Phiuphong C, Pattapong S, Siripan S. Foreign Body Ingestion in Pediatrics: Distribution, Management and Complications. *Med Kaunas Lith*. 2019;55(10):686. doi:10.3390/medicina55100686
5. Gatto A, Capossela L, Ferretti S, et al. Foreign Body Ingestion in Children: Epidemiological, Clinical Features and Outcome in a Third Level Emergency Department. *Children*. 2021;8(12):1182. doi:10.3390/children8121182
6. Mantegazza C, Destro F, Ferraro S, et al. Recent trends in foreign body ingestion (FBI) epidemiology: A national cohort study. *Dig Liver Dis*. 2025;57(2):595-602. doi:10.1016/j.dld.2024.10.002
7. Paul RI, Christoffel KK, Binns HJ, Jaffe DM, The Pediatric Practice Research Group. Foreign Body Ingestions in Children: Risk of Complication Varies With Site of Initial Health Care Contact. *Pediatrics*. 1993;91(1):121-127. doi:10.1542/peds.91.1.121
8. Conners, G. P., & Mohseni, M. Pediatric foreign body ingestion. In: 2025th ed. StatPearls Publishing. <https://www.ncbi.nlm.nih.gov/books/NBK430915/>
9. Oliva S, Romano C, De Angelis P, et al. Foreign body and caustic ingestions in children: A clinical practice guideline. *Dig Liver Dis*. 2020;52(11):1266-1281. doi:10.1016/j.dld.2020.07.016
10. Kramer RE, Lerner DG, Lin T, et al. Management of Ingested Foreign Bodies in Children: A Clinical Report of the NASPGHAN Endoscopy Committee. *J Pediatr Gastroenterol Nutr*. 2015;60(4):562-574. doi:10.1097/MPG.0000000000000729
11. Di Mitri M, Parente G, Bisanti C, et al. Ask Doctor Smartphone! An App to Help Physicians Manage Foreign Body Ingestions in Children. *Diagnostics*. 2023;13(20):3285. doi:10.3390/diagnostics13203285
12. Slee VN. The *International Classification of Diseases* : Ninth Revision (ICD-9). *Ann Intern Med*. 1978;88(3):424-426. doi:10.7326/0003-4819-88-3-424
13. Pugmire BS, Lim R, Avery LL. Review of Ingested and Aspirated Foreign Bodies in Children and Their Clinical Significance for Radiologists. *RadioGraphics*. 2015;35(5):1528-1538. doi:10.1148/rg.2015140287
14. Orsagh-Yentis D, McAdams RJ, Roberts KJ, McKenzie LB. Foreign-Body Ingestions of Young Children Treated in US Emergency Departments: 1995–2015. *Pediatrics*. 2019;143(5):e20181988. doi:10.1542/peds.2018-1988
15. Conners GP, Chamberlain JM, Weiner PR. Pediatric coin ingestion: A home-based survey. *Am J Emerg Med*. 1995;13(6):638-640. doi:10.1016/0735-6757(95)90047-0
16. Litovitz T, Whitaker N, Clark L. Preventing Battery Ingestions: An Analysis of 8648 Cases. *Pediatrics*. 2010;125(6):1178-1183. doi:10.1542/peds.2009-3038
17. Bolton SM, Saker M, Bass LM. Button battery and magnet ingestions in the pediatric patient. *Curr Opin Pediatr*. 2018;30(5):653-659. doi:10.1097/MOP.0000000000000665
18. Shatani N, Alshaibani S, Potts J, Phillips B, Bray H. Chest Radiograph Alone Is Sufficient as the Foreign Body Survey for Children Presenting With Coin Ingestion. *Pediatr Emerg Care*. 2021;37(9):e524-e527. doi:10.1097/PEC.0000000000001688
19. Yang TW, Yu YC, Lin YY, et al. Diagnostic Performance of Conventional X-ray for Detecting Foreign Bodies in the Upper Digestive Tract: A Systematic Review and Diagnostic Meta-Analysis. *Diagnostics*. 2021;11(5):790. doi:10.3390/diagnostics11050790
20. Squires RH, Morriss F, Schluterman S, Drews B, Galyen L, Brown KO. Efficacy, safety, and cost of intravenous sedation versus general anesthesia in children undergoing endoscopic procedures. *Gastrointest Endosc*. 1995;41(2):99-104. doi:10.1016/S0016-5107(05)80589-9
21. Iyer H, Bouhadana G, Cugno S. Local Versus General Anesthesia in Pediatric Otoplasty: A Cost and Efficiency Analysis. *Cleft Palate Craniofacial J*. 2024;61(11):1879-1885. doi:10.1177/10556656231186268
22. Marchili MR, Bozzola E, Guolo S, et al. Pediatric acute hospitalization for anorexia nervosa: an economic evaluation. *Ital J Pediatr*. 2024;50(1):33. doi:10.1186/s13052-024-01605-0
23. Bozzola E, Spina G, Marchili MR, et al. Pediatric Hospitalization for Varicella in an Italian Pediatric Hospital: How Much Does It Cost? *Int J Environ Res Public Health*. 2021;18(22):12053. doi:10.3390/ijerph182212053







Declaration of interests

☒ The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

☐ The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: