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(RESEARCH ARTICLE)

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Patterns of ingested foreign bodies at a tertiary paediatric emergency department: A 5-year time series analysis

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Abstract

Background: Foreign body ingestion is common in children worldwide, and is associated with significant morbidity and occasionally, mortality. The objective of this study was to elucidate the demographics, presentation, management and outcomes for children presenting with ingestion of foreign bodies.

Methods: Data were collected for 1202 children up to 16 years of age who presented to Addenbrooke's Hospital, Cambridge over a 5-year period between 2016 and 2021.

Results: The majority of patients were male (n=672, 56%) and the median age was 3.0 years (range 0-15). 75% were under 6 years of age. 165 (13.7%) were infants (<12 months old). 160 (13.3%) patients were admitted, and of those, 95 (60%) required interventions necessitating general anaesthesia. Button battery ingestions were most likely to require general anaesthesia (31%), compared to 17% for coins, 9.5% for magnets and 7.9% overall. Seven patients required laparotomy (including 5 for bowel perforation), all in patients who had ingested multiple magnets. Of particular concern, there was a sixfold increase in the number of magnet ingestions over the period of the study.

Conclusion: This study demonstrates the continuing significant morbidity associated with foreign body ingestion in children, with almost 1 in 7 patients being admitted to hospital and 1 in 12 requiring interventions under general anaesthesia. The most serious morbidity is associated with magnet and button battery ingestion. Public campaigns to raise awareness of the dangers of small objects in a child's environment, particularly magnets, aimed directly at parents and carers, should be made a priority.

Keywords: Foreign Body; Paediatrics; Ingestion; Anaesthesia

1. Introduction

The ingestion of foreign bodies by children between the age of 6 months and 4 years is commonly seen in Western societies [1]. This is a critical time where children develop by exploring their immediate environment with their main senses; by six months of age, babies take in more information through their mouth than any other sense. The majority of cases of ingestion of foreign bodies can be managed conservatively, as most objects pass through the gastrointestinal tract without causing harm to the child. However, some objects, particularly button batteries and small magnets, have the potential to cause life-changing or even life-threatening injuries, even if their ingestion is recognised promptly and managed appropriately. This led to the 2020 winter campaign by the British Association of Paediatric Surgeons to highlight the life changing complications caused by button batteries [2]. Concerns were also raised when a 5-year study

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conducted by the Quadri-South East Paediatric Surgeons (QuadriSEPS) Group showed a 56% increase in cases of children with foreign body ingestion from 2016 to 2020 [3], along with a fivefold increase in the incidence of magnet ingestions in the same period. This study clearly demonstrated the growing problem with these objects. The accidental injuries associated with the ingestion of foreign bodies led the QuadriSEPS group to recommend a strong public health campaign in the United Kingdom (UK) to increase awareness of the dangers of small, powerful magnets. The Royal College of Emergency Medicine (RCEM) issued a Best Practice Guideline on the ingestion of super strong magnets in children in May 2021 [4], and a National Patient Safety Alert was issued by NHS England shortly after [5].

Our study aims to describe the prevalence, management and outcomes of ingested foreign bodies in children over the same 5-year period, in a tertiary paediatric emergency department.

2. Methods

We conducted a retrospective study looking at the presentation and management of ingested foreign bodies in children who presented to Addenbrooke's Hospital, Cambridge over a 5-year period (2016-2021). All children under the age of 16 years old with witnessed or suspected foreign body ingestion were included in the study. The data (age, sex, type of foreign body, presenting symptoms, investigations and management) were collected from patients' records and imaging files.

3. Results

A total of 1202 children presented to the Cambridge University Hospitals A&E Department with foreign body ingestion between January 2016 and January 2021. A small majority of patients were male (n=672, 56%) and most had no comorbidities recorded (n=908, 75%). The median age was 3.0 years (Range 0-15). Over three quarters of the patients (n=909, 76%) were under 6 years of age (figure 1), with an almost exponential fall in numbers after age 1.

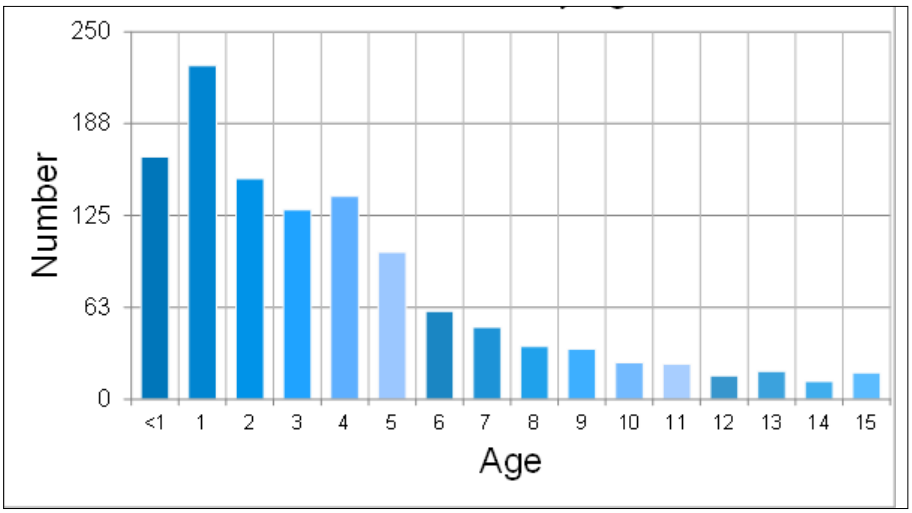

Figure 1 Number of cases by Age

Table 1 Demographics of children (<16 years of age) presenting to Addenbrookes Hospital ED following ingestion of a foreign body.

Total	**1202**	**%**
Male	672	56
Female	530	44
Age		
<1	165	13.7
1-2 years	377	31.3

3-5 years	367	30.5
6-11 years	228	18.9
≥12 years	65	5.4
Clinical presentation		
Asymptomatic	651	54
Symptomatic	509	42
Undocumented	42	3.5
Comorbidities		
Asthma	48	3.9
Autism	17	1.4
Sleep apnoea	16	1.4
Eczema	16	1.4
Congenital heart disease	23	1.9
Tracheo/laryngomalacia	12	0.97
Autism	18	1.5
ADHD	7	0.6

3.1. Infants

Ingestion of a foreign body was suspected rather than certain in 57% (n=95) of infants compared to an all-age average of 24% (n=286). Infants also had a higher likelihood of the nature of the foreign body being unknown (n=8, 4.8%), which poses an issue when trying to decide on a management plan. Despite the uncertain history, infants were under-investigated compared to their older peers. Only 37.5% (n=62) of infants had any investigations performed in the Emergency Department compared to an all-age average of 61% (n=732).

3.2. Time of presentation

Children most commonly presented in the evening between 18:00 and 21:00, with older children presenting later in the evening. A trough in presentations across all ages was seen after midnight. No clear trend was observed in the weekday of presentation, with school days and weekends seeing similar attendance patterns.

3.3. Foreign bodies

By far the most common foreign bodies ingested were coins (n=248, 20.6%), heavily clustered in the younger years, with 227 (91.5%) in children 7 years old or under. In this group, 72 (32%) required removal by oesophagog astroduodenoscopy (OGD) or rigid oesophagoscopy due to failure to transit through the oesophagus, most being stuck at the level of cricopharyngeus or below. Other common items were plastic (n=195, 15.9%), metal other than magnets or coins (n=156, 12.7%) and food items such as berries, carrot, apple etc. (n=143, 12%). Of particular concern, there were 68 (5.7%) cases of magnet ingestion, 34 (2.8%) of button battery ingestion, and 73 (6.0%) of other types of battery ingestion. There was a sixfold increase in the number of magnet ingestions from 2016 to 2020, the proportion of which increased from 0.33% of all cases in 2016, to 2.25% in 2020, a trend similar to that reported by the QuadriSEPS group (figure 2)

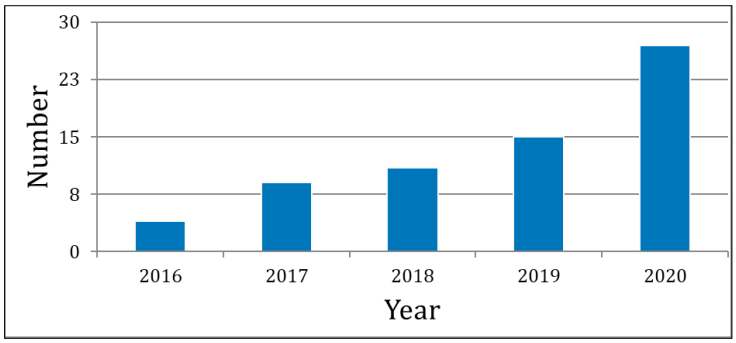

Figure 2 Magnet Ingestions by Year

Interestingly, button battery ingestions did not mirror this upward trend (figure 3), although in this group there was a very high admission rate (78% vs 14.6% overall), and a high operative intervention rate (34% vs 7.9% overall), with one delayed presentation of 5 days after ingestion who required major tracheo-oesophageal surgery. 70% of button battery ingestions were in the under 5 age group.

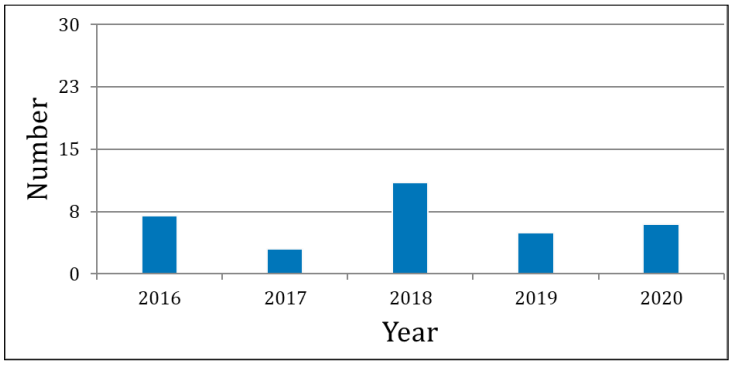

Figure 3 Button Battery Ingestions by Year

3.4. Presenting symptoms and comorbidities

Over half (54%) of the patients were asymptomatic, emphasising that the absence of symptoms does not preclude an ingested foreign body. Amongst the symptomatic patients, the most frequently reported symptoms were throat pain, abdominal pain, cough and choking. Other reported symptoms included nausea and vomiting, chest pain, difficulty breathing, difficulty swallowing, drooling and coughing up blood.

Over 75% of children had no comorbidities, and of those who did, asthma was the most frequent with 47 cases (4%).

3.5. Investigations and outcomes

Chest X-ray (n=417, 34%) was the most common investigation carried out in children over 1 year of age, except between 3 to 5 years, where use of a metal detector was more frequent (112 CXR vs 147 metal detector), likely due to the high rate of coin ingestion (n=126, 47%) in this age group. Abdominal X-rays were performed in 14% of cases, whereas neck X-rays (n=46, 3.7%) were uncommon.

Hospital admission was required in 160 (13.3%) cases, and 95 (60%) of these required interventions under general anaesthesia, itemised in figure 4. There were 7 laparotomies, 5 of which already had multiple bowel perforations at the time of surgery (all in cases of multiple magnet ingestion). The range of objects requiring operative intervention was large, and included Lego, crayons, cat litter, drawing pins, peanuts, carrots, earrings and boiled sweets, among many others. No general trend was observed with respect to age and the likelihood of admission or re-attendance within a 28-day window.

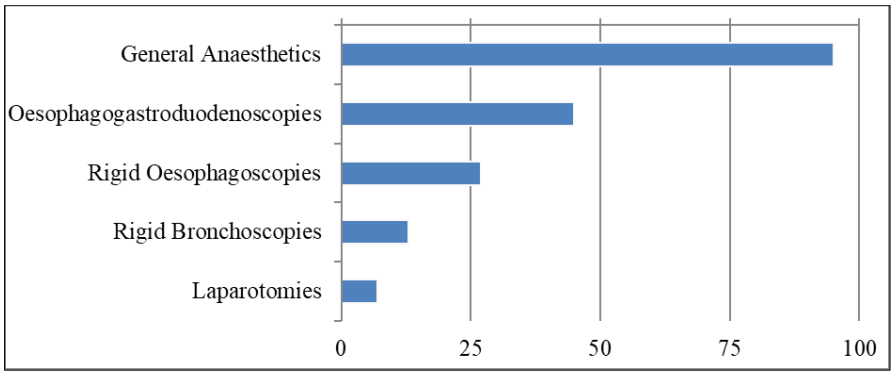

Figure 4 Outcomes

4. Discussion

Foreign body ingestion in children is a common paediatric emergency but can also be one of the most challenging clinical scenarios facing Emergency Department physicians and paediatricians. The majority of ingested foreign bodies do not cause any injury and pass spontaneously through the gastrointestinal tract. However, according to Louie and Bradin, 10 to 20 % of patients require non-surgical intervention and about 1% require surgery; results of the current study broadly agree with these [6].

The age, gender distribution and symptomatology in our study are consistent with those reported by other authors, such as Adhikari et al [7]. Our study revealed a great variety of ingested objects, with coins being the most frequently ingested objects, very similar to Rybojad et al's findings [8].

Of particular concern in this study is the worryingly rapid rise in the number of magnet ingestions (greater than a six-fold increase) seen over the study period; magnets seem particularly attractive to younger children (70% of all magnet ingestions occurred in children below 7 years of age). This is especially concerning as all of the laparotomies in this study were required in children who had ingested multiple magnets, demonstrating the highest morbidity in this group. The concern about magnet ingestions, particularly of small, powerful ("buckyball" type) rare earth magnets, is well recognised and documented (Price et al [9], RCEM [4], QuadriSEPS Group [3], Royal Society for the Prevention of Accidents [10], United States Consumer Product Safety Commission [11], Canada Consumer Product Safety Act [12]), and various legislative measures (including total product recalls, bans on the manufacture, importing and selling of such products, setting strict standards for the size and strength of magnets used, mandating stringent safety warnings, or limiting sales to those over the age of 14) have been undertaken by governments in an attempt to reduce the risk to children posed by these magnets. The impact of these legislative measures and public health campaigns will need to be studied post their implementation.

Limitations

The main limitation of this study is that it is a retrospective review of data collected from a single paediatric emergency centre. However, given the results of a recent national multi-centre survey looking exclusively at magnet ingestions over a single year, (Price et al [9]), it is likely that the national picture is similar to our results.

5. Conclusion

This study demonstrates that foreign body ingestion continues to be a source of significant morbidity in children, particularly younger children. The majority of foreign body ingestions are harmless; however magnets and button batteries cause significant morbidity and have the highest incidence of requiring operative intervention, with the under 5s being most at risk.

This study adds to existing national data supporting robust implementation of legislation and public awareness campaign to highlight the dangers of these objects in young children.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Funding statement

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Data sharing statement

All data relevant to the study are included in the article.

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