Cross-Sectional Study

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Prevalence and risk factors associated with hypopharyngo-esophageal foreign bodies impaction: a cross-sectional study

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Introduction: Ingestion of foreign bodies (FBs) is an emergency condition which may be associated with challenges for their removal. We aimed to assess the prevalence and factors associated with hypopharyngo-esophageal foreign bodies (HP-EFBs) impaction.

Methods: A cross-sectional study was conducted at Mulago national referral hospital in Uganda from August 2018 to May 2019. The study consisted of 150 patients aged 6 months to 49 years with suspicion of HP-EFBs impaction. Binary logistic regression analysis was applied to determine factors associated with HP-EFBs. Statistical significance was set at $P < 0.05$.

Results: The median age of the patients was 7.1 (4.3–16.4) years, and males accounted for the majority (64%, $n = 96$) of the patients. Clinically, majority (62.0%, $n = 93$) of the patients had dysphagia. The prevalence of HP-EFBs was (33.3%, $n = 50$). Majority (76.0%, $n = 38$) of the FBs were coins. Being aged ≤5 years (aOR = 1.47, 95% CI = 2.18–3.39, $P = 0.043$), being a child attending school (aOR = 2.03, 95% CI = 1.56–4.92, $P = 0.037$), and being under caretakers aged ≤25 years (aOR = 6.83, 95% CI = 1.88–24.79), $P = 0.003$) were associated with increased risk of HP-EFBs impaction.

Conclusion: This study has shown increased risk of HP-EFBs impaction particularly in male children and those attending school. Also, patients who were under younger caretakers had increased odds of HP-EFBs impaction. There is a need for caretakers and teachers at school to provide emphasis for children to always have precaution to avoid impaction of FBs.

Keywords: foreign bodies, hypopharyngo-esophageal, risk factors

Introduction

Foreign body (FB) ingestion represents a major global public health problem especially in children[1] aged between 6 months and 6 years worldwide[2]. Despite the development of endoscopic techniques which are useful in removal of most of the FBs (between 80% and 90%) by skilled endoscopists[2], and approximately 1% of them necessitate thoracic surgery for their removal[3]. FBs that are successfully removed by endoscopic approach do not cause complications, however, others may cause complications such as perforation, bleeding, and migration[4]. FBs ingestion is one of the most common emergency conditions in the ear, nose, and throat (ENT) clinics and it is associated with significant morbidity and mortality. Studies have reported between 500 and 2000 new cases of FBs ingestion globally[5,6].

Impaction of FBs along the aerodigestive track may take place at different level including hypopharynx, hypopharyngo-esophageal, esophagus, and stomach. Hypopharyngo-esophageal foreign bodies (HP-EFBs) ingestion commonly involves inorganic materials with coins being the most common FBs to be ingested especially among children[7,8]. Other objects include toy parts, jewels, disc batteries, fish and chicken bones among many others[9]. For example, in a study done in Iran by Jafari *et al*, the commonest type of FBs ingested were disc batteries which accounted for 41%[10]. In a study done in India, it was reported that 74% of the patients had FBs involving the aerodigestive[11]. In Tanzania, EFBs account for 55.1% of aerodigestive tract FBs[12].

Patients with HP-EFBs ingestion have a considerable variation of signs and symptoms, though the most common signs and symptoms include dysphagia, FB sensation in the throat, drooling saliva, odynophagia, and vomiting[13-15]. However, it should also be known that approximately 43.5% of cases with HEFB ingestion are asymptomatic[11]. Ingestion of FBs including HP-EFBs in particular, is influenced by a number of factors including sociodemographic and socioeconomic characteristics, and lifestyle behaviors. Having young age (<5 years) and being a male child contribute significantly to ingestion of FBs[2,16,17]. Also, belonging to a class of high socioeconomic status (SES) has been associated with reduced risk of FBs

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ingestion. Children of families with high SES have lower odds of encountering HP-EFBs ingestion compared to their counterparts[17].

Documentation of the prevalence of FBs ingestion in Uganda and other resource-limited countries is still a challenge which creates a gap in practice, knowledge, and management among different groups of stakeholders including healthcare providers, patients, and the public in general. The present study aimed to investigate the prevalence of HP-EFBs and the associated risk factors in a cohort suspected clinically to have FBs impaction.

Materials and methods

Study design and setting

This was a cross-sectional study which was conducted in the department of ENT, at Mulago national referral hospital (MNRH) in Kampala, Uganda from August 2018 to May 2019. MNRH is a tertiary referral and consultant national hospital which is located in the capital city of Kampala. The hospital mainly provides specialized medical services for patients referred from different parts of the country as well as other neighboring countries such as Kenya, Rwanda, and Democratic Republic of Congo (DRC). Approximately, the department of ENT 450 both children and adults outpatients per month who are brought from within the country.

Study population

The study population consisted of patients aged between 6 months and 49 years who presented at the department of ENT after being referred from the department of emergency medicine with suspicion of impaction of FBs along the hypophango-esophageal sites. Presence of HP-EFBs was confirmed using x-ray and rigid endoscopy. All patients with mental retardation, neurological abnormalities, and medical conditions that could affect normal feeding were excluded from the study.

Sampling method and data collection

Sampling was done using convenience sampling method and patients were recruited consecutively until the sample size of 150 patients was obtained. Data were collected using a self-designed research tool which consisted the following sections: sociodemographic characteristics for children caretakers, clinical signs and symptoms, endoscopic findings, and type of HP-EFBs recovered. For the purpose of maintaining privacy, the process of data collection was done in a secluded room. One of the researchers (EK) and other two research assistants (medical officers) with experience of working at the department of ENT were responsible for data collection. Patients who were presenting with features of HP-EFBs were evaluated clinically, and patients that required a lateral neck or chest x-ray to confirm the presence of HP-EFB had an x-ray first done, and those with HP-EFB seen on x-ray were recruited at this point followed by rigid endoscopic examination to confirm presence of HP-EFB.

Data analysis

Data were analyzed using STATA program version 10.0. Cleaning of the data was done by running crosstabs and frequency tables for checking missing and duplicated data. Categorical variables and continuous variables were summarized in frequency and percentage and median (interquartile range; IQR), respectively. Bivariate logistic regression analysis was used to determine factors associated with HP-EFB impaction. All variables with $P < 0.2$ were taken further to multivariate analysis in order to adjust for confounding factors. A two-tailed $P < 0.05$ was regarded as statistically significant.

Results

Baseline characteristics of patients

A total of 150 patients who were suspected clinically to have HP-EFBs were included in the present study. The median age of the patients was 7.1 (4.3–16.4) years. Most (50.7%, $n = 76$) of the patients were aged not more than 5 years. Males accounted for majority (64.0%, $n = 96$) of the cases with male to female ratio of 1.8:1. Regarding education level, most (53.3%, $n = 80$) of the patients had attained or were in primary school. The mean time from impaction of FB to presentation to hospital was (2.4 ± 3.2) days and the earliest and late presentation was 6 hours and 3 weeks, respectively (Table 1).

Prevalence of foreign bodies and endoscopic findings

The FBs were found in one-third (33.3%, $n = 50$) of all the patients examined. The vast majority (78.0%, $n = 38$) of the HP-EFBs were recovered in the upper third of the hypopharyngo-esophageal

Table 1

Baseline characteristics of categories of study participants (N = 150)

Variables	Frequency (*n*)	Percentage (%)
Age (years)		
≤5	76	50.7
6–10	41	27.3
11–17	24	16.0
≥18	9	6.0
Sex		
Male	96	64.0
Female	54	36.0
Attending school among children		
Yes	112	88.2
No	15	11.8
Age of caretakers (years)		
≤25	45	30.0
26–35	69	46.0
>35	36	24.0
Number of children per household		
≤5	67	44.7
>5	83	55.3
Marital status of caretakers		
In a relationship	88	58.7
Single	62	41.3
Education level of caretakers		
No formal education	17	11.3
Primary school	80	53.3
Secondary school	46	30.7
Tertiary	7	3.3
Caretakers' intake of alcohol		
Yes	13	8.7
No	37	24.7

Table 2

Prevalence of foreign bodies and endoscopic findings

Variables	Frequency (*n*)	Percentage (%)
Presence of foreign body (*n* = 150)		
Yes	50	33.3
No	100	66.7
Positioning of foreign bodies (*n* = 50)		
Upper third	39	78.0
Middle third	9	18.0
Lower third	2	4.0
Types of foreign bodies recovered (*n* = 50)		
Ugandan coins	38	76.0
Denture	1	2.0
Disc battery	3	6.0
Ear rings	2	4.0
Fish bones	3	6.0
Metallic objects	2	4.0
Nail cap	1	2.0
Abnormal endoscopic findings (*n* = 50)		
Bleeding	9	18.0
Mucosal laceration	6	12.0
Mucosal ulceration	5	10.0
Mucosal necrosis	4	8.0
Unremarkable mucosal surface	26	52.0
Foreign bodies seen on x-ray (*n* = 50)		
Yes	46	92.0
No	4	8.0
Removal of impacted foreign bodies (*n* = 50)		
Endoscopic approach	47	94.0
Thoracic surgery	3	6.0

track. Removal of the impacted HP-EFBs using endoscopic approach with forceps was successful in majority (94.0%, *n* = 47) of the cases. The coins accounted for the majority (76.0%, *n* = 38) of the recovered HP-EFBs. Of all the cases with FBs, abnormal mucosal surfaces were found in almost half (48.0%, *n* = 24), and bleeding was the most (37.5%, *n* = 9) common abnormal endoscopic finding (Table 2). Figure 1a-c shows examples of the HP-EFBs that were recovered.

Clinical presentation of the patients

Figure 2 shows the clinical features of the patients. Dysphagia was the commonest clinical presentation which was present in (62.0%, *n* = 31) of all the cases followed by odynophagia and vomiting or retching which accounted for (60.0%, *n* = 30) each. The least common symptoms were difficulty in breathing and cough which both comprised (4.0%, *n* = 2). The two cases with difficulty in breathing or cough, one case had ingested a disk battery that put pressure on the trachea anteriorly and the other one ingested an ear ring, when guardians tried to retrieve the object from the point of impaction with a finger and ended up the FB into the lateral pharyngeal wall at its upper end and its lower end into the cricopharyngeus, with the rest of the FB putting pressure on supraglottic structures.

Factors associated with ingestion of hypopharyngeal-esophageal foreign bodies

Table 3 shows factors associated with recovery of HP-EFBs. When bivariate regression analysis was performed, it was observed that age (uOR = 1.61, 95% CI = 1.74–5.02, *P* = 0.025) and sex (uOR = 2.33, 95% CI = 1.49–5.97, *P* = 0.008) of the cases, attending school for the cases (uOR = 1.81, 95% CI = 1.39–9.74, *P* = 0.021), caretakers' age (uOR = 2.90, 95% CI = 0.78–10.75), *P* = 0.008) were associated with increased risk of HP-EFBs impaction. However, number of children per household (uOR = 0.62, 95% CI = 0.29–0.78, *P* = 0.034) was associated with reduced risk of HP-EFBs impaction. After adjusting for age and sex of cases, attendance of cases to school, caretakers' age and sex, caretakers' marital status, level of education and intake of alcohol, and number of children per household under multivariate analysis, it was observed only age of cases, attendance of cases to school, and caretakers' age remained the factors significantly associated with HP-EFBs impaction. Children who were aged ≤5 years had increased risk for HP-EFBs impaction (aOR = 1.47, 95% CI = 2.18–3.39, *P* = 0.043) compared to patients who were aged above 5 years. Children who were attending school were 2 times more likely to have HP-EFBs impaction than cases that were not attending school (aOR = 2.03, 95% CI = 1.56–4.92, *P* = 0.037). Also, children or patients who were under caretakers aged ≤25 years were almost 7 times more likely to encounter HP-EFBs impaction than those who were under caretakers aged >35 years (aOR = 6.83, 95% CI = 1.88–24.79, *P* = 0.003).

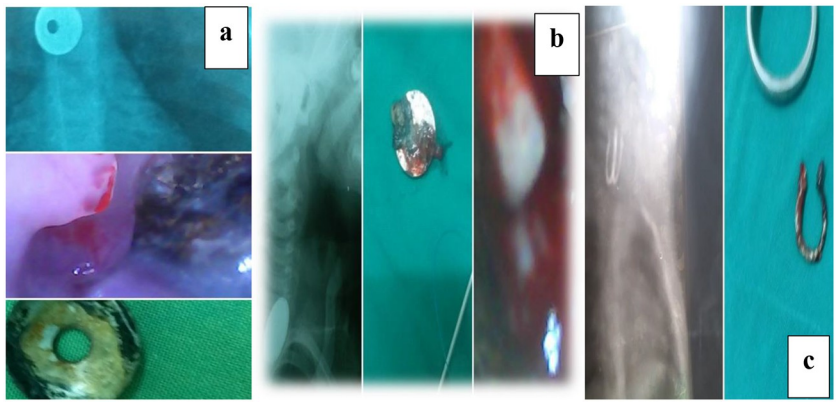

Figure 1. Photographs of some of the recovered foreign bodies: (a) nail cap, (b) disc battery, and (c) ear ring.

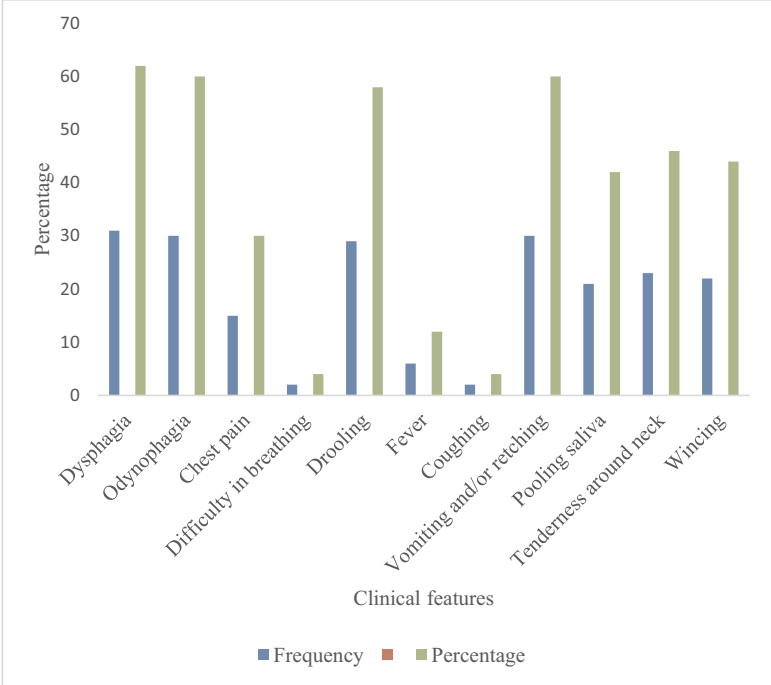

Figure 2. Clinical features of the patients with hypopharyngeal-esophageal foreign bodies.

Discussion

Ingestion of FBs along the aerodigestive tract represents a major global public health problem, especially in children and also in resource-limited settings. Assessing factors associated with FBs ingestion provides a means for understanding the diagnosis, management, and prevention of patients with FBs ingestion along the aerodigestive tract such as those with HP-EFBs ingestion.

The majority of cases in this study were males, and the male to female ratio was 2:1. Also, children not aged more than 5 years was the age group of patients with the highest percentage. These findings are in agreement with the findings in the study of Nakku *et al* in which the male to female ratio was 2:1, and children aged not more than 5 years accounted for majority of cases[17]. Similarly, other previous studies have also reported high percentage of FBs impaction in males and among under-5[12,18,19]. This is because younger children tend to explore their environment by mouthing and touching. Children prefer placing objects in their mouths either as part of a game or sometimes they use their mouths for temporary repository while the hands are otherwise occupied. By so doing, the object may accidentally get ingested[16].

The clinical presentation of patients with FBs along the aerodigestive track varies depending on the point of impaction and nature of the object ingested. Age of the patient and size of the object ingested have also been reported to determine the way how the affected patient can present clinically[20]. Gagging, drooling, and poor feeding are the common clinical presentations in infants with HP-EFBs ingestion whereas old children usually present with chest pain, dysphagia, and odynophagia[20]. Adults usually present clinically with dysphagia, and if the obstruction is complete, they tend to present with drooling of saliva[21]. In this study, the most common clinical presentation was dysphagia followed by odynophagia. Similarly, in other previous studies it was found that most of patients were manifesting clinically with dysphagia and odynophagia[10,11]. Such clinical signs and symptoms may help in quickening the process of removal of the ingested objects due to increased index of clinical suspicion.

Impaction of various FBs along the aerodigestive tract usually causes gross morphological changes on the mucosal surfaces due to pressure effects or direct trauma, and sometimes abnormal findings may develop as a result of attempts to remove them. Almost half of the cases in the present study had abnormal endoscopic findings including bleeding and laceration. In the study of Jafari *et al*, it was reported that, over one-third of the patients with esophageal FBs ingestion had abnormal endoscopic findings including esophageal mucosal erythematous changes, erosion, ulceration, and necrosis[10]. However, in the study of Rybojad et al. it was found that, only 11.4% of the cases had abnormal endoscopic findings[22]. The abnormal endoscopy findings are comparable to our study although our findings were slightly higher. This is because our study included adult patients which widen the nature of FBs to include sharp objects like fish bones and dentures that are potentially traumatic to the mucosa. There are also local beliefs that esophageal FBs can be managed by swallowing a large bolus of half-chewed feeds or bananas to push the FB in the stomach[23]. Others believe in retrieving the FB by inducing vomiting. These attempts instead cause damage to the esophageal mucosa.

Lack of specific history and non-specific symptoms among patients with FBs ingestion, poses a diagnostic challenge and management. Application of imaging plays a crucial role in the diagnosis and provides guidance for the clinical management of such patients. Plain x-ray is important in investigation of patients suspected for ingesting FBs, however, approximately 80% of FBs tend to be

Table 3

Factors associated with being found with hypopharyngo-esophageal foreign bodies

Variables	Bivariate analysis uOR (95% CI)	*P*	Multivariate analysis aOR (95% CI)	*P*
Age (years)				
≤5	1.61 (1.74–5.02)	0.025	1.47 (2.18–3.39)	0.043
>5	1.00		1.00	
Sex of the cases				
Male	2.33 (1.49–5.97)	0.008	1.91 (0.68–2.05)	0.063
Female	1.00		1.00	
Attending school among children				
Yes	1.81 (1.39–9.74)	0.021	2.03 (1.56–4.92)	0.037
No	1.00		1.00	
Caretakers' age (years)				
≤25	2.90 (0.78–10.75)	0.008	6.83 (1.88–24.79)	0.003
26–35	1.37 (0.49–14.58)	0.114	1.93 (0.21–24.30)	0.097
>35	1.00		1.00	
Caretakers' sex				
Male	1.44 (0.62–5.01)	0.602	–	–
Female	1.00			
Marital status of caretakers				
In a relationship	0.61 (0.29–1.28)	0.192	0.91 (0.403–2.11)	0.075
Single	1.00		1.00	
Caretakers' level of education				
No informal education	3.68 (0.35–38.82)	0.278	–	–
Primary	3.71 (0.39–35.13)	0.253	–	–
Secondary	3.13 (0.33–29.92)	0.322	–	–
Tertiary	1.00			
Number of children per household				
≤5	0.62 (0.29–0.78)	0.034	0.43 (0.81–7.17)	0.055
>5	1.00		1.00	
Caretakers' intake of alcohol				
Yes	1.01 (0.24–3.67)	0.833	–	–
No	1.00			

radiolucent which obscures visualization by the one examining[21]. Fluoroscopy and multidetector computed tomography (MDCT) have been found to be useful in providing ancillary support in detection of ingested FB in complex cases[20]. Detection rate of FBs using plain x-ray in the present study was as high as that reported in previous studies ranging between 73% and 90%[17,24]. Variation in experience of the radiologists and nature of main study subjects could contribute to the differences of the ability of x-ray to detect FBs. In this study, majority of the HP-EFBs ingestion was found in the upper third of the involved anatomical sites. This is in agreement with the findings in the previous studies[11-13,25]. It has been shown that, FBs have increased tendency to having impaction at the narrowest regions such as the glottis and the cricopharyngeal sphincter[26]. The type of ingested FB varies in different societies; the nature of the FB depends on social, economic, and cultural factors[22]. Coins of Ugandan shillings were the most common HP-EFBs recovered in this study similar to the findings in the studies done previously[11,12]. However, in the study which was done in Iran it was found that disc batteries were the most common FBs recovered[10]. In our study, the disc batteries were the second commonest along with earrings and fish bones. This is due to the increased use of disc batteries in electronic gadgets like toys, calculators, electronic games among many others.

The risk of FBs ingestion is influenced by a number of factors including sociodemographic characteristics and certain health related factors. In this study, younger children who were not having more than 5 years had increased odds of having HP-EFBs ingestion. This is similar to the findings in the previous studies[17,19,27,28]. The reason for the increased risk of FBs ingestion in younger children has been shown to be related to decreased chewing ability due to absence of molar teeth, inquisitiveness to discover the outer world with oral action, and forced inspiration upon being startled, crying or laughing as well as deep inspiration or laughing[12]. Furthermore, it was observed that patients especially who were attending school had also increased possibility of HP-EFBs ingestion. This may be due to the fact that, most school children have a habit of playing with coins normally given to them by their caretakers. Accidentally or intentionally while placing the coins in their mouths, they end up ingesting them. Patients who were under caretakers (parents or guardians) not aged above 25 years had increased risk of HP-EFBs ingestion whereas patients that were under guidance of caretakers aged above 25 years, they were protected against HP-EFBs ingestion. Similarly, in the study of Nakku *et al* it was observed that, children who were under care of mothers aged more than 35 years had reduced risk of HP-EFBs ingestion[17].

Limitations of the study

There were some limitations which the methodological part of this study faced including the following: some of caregivers had

prolonged or unknown periods of HP-EFBs ingestion leading to recall bias of some symptoms and duration of ingestion. Also, the results lack generalizability due to small sample size and being single institution based.

Conclusion

Patients who were males and those aged not above 5 years had increased risk of HP-EFBs ingestion. Dysphagia was the most common presenting symptoms and coins of 100 shillings were the most recovered type of FBs. Also, attending school for children and being under caretakers of age not more than 25 years were associated with increased risk of HP-EFBs ingestion.

Ethics approval

Ethical approval was granted by the institution review board of the school of medicine (reference SoM.128/HD/18), Makerere College of Health Sciences which is a constituent of Makerere University.

Consent

For the minors, written informed consent was obtained from parents/caregivers for their children to participate in the study. The study was performed in accordance with the Makerere University ethical guidelines for research involving human subjects and the ethical standards of the Declaration of Helsinki.

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Author's contribution

E.K., J.N., J.A., R.B.: conception, designing, data collection, and methodology; E.K., T.O., J.J.Y.: statistical analysis, interpretation, writing the first draft of the manuscript. All authors revised critically the final version of the manuscript for submission.

Conflict of interest disclosure

The authors declare no competing interests.

Research registration unique identifying number (UIN)

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Data availability statement

The datasets used during this study will be available from the corresponding author upon reasonable request.

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