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ORIGINAL RESEARCH

The Prevalence and Management of Aerodigestive Foreign Bodies at Rwanda Military Hospital: A Six-years Retrospective Study

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Background: Aerodigestive foreign bodies are common issue especially in children, who often place objects in their mouths, leading to inhalation or ingestion. Despite global data on this issue, no comprehensive study has been conducted in Rwanda. This study aimed to assess the prevalence, demographic factors, clinical presentations, diagnostic and management techniques of aerodigestive foreign bodies at Rwanda Military Hospital (RMH).

Methods: This retrospective study reviewed patient records from ENT department of RMH over the period of six years, from January 2017 to December 2022. Data on aerodigestive foreign bodies were extracted from operating room archives and OpenClinic hospital online system, then compiled in Excel spreadsheet, and descriptively analyzed using and SPSS 23.

Results: Among 39,240 patients who consulted the ENT department over the six years, 290 (0.74%) cases of aerodigestive foreign bodies were identified, with male-to-female ratio of 1.34:1. The highest incidence was in children aged 1–3 years (49.66%). Inorganic foreign bodies, especially coins (35.17%), were more common than organic ones. Clinical presentations varied, with 46.21% of cases being asymptomatic, and others showing drooling (17.93%) and dysphagia (9.66%). Chest X-rays were the most frequently used diagnostic tool (49.66%). Esophagoscopy was the primary management method for esophageal cases (45.52%), with bronchoscopy (13.10%) and forceps (34.14%) used for bronchial and nasal cases, respectively.

Conclusion: Aerodigestive foreign bodies, particularly coins, are prevalent in Rwanda, especially among young children and males. This highlights the need for targeted preventive strategies and educational programs to reduce incidence and improve management.

Keywords: foreign bodies, otolaryngology, diagnostics, management, Rwanda

Background

Foreign bodies (FBs) are items from the external environment that are found partially or entirely within the body. Aerodigestive foreign bodies are those lodged in the respiratory or digestive systems. They can either be inhaled into the respiratory tract, known as foreign body aspiration, or swallowed and become trapped in the digestive system, referred to as foreign body ingestion.[1] Foreign body ingestion and aspiration often come with a vague or unclear history, particularly in children, leading to potential underdiagnosis. In adults, such cases are usually accidental, except in those with mental health disorders. In contrast, children, whose airways and digestive systems are still developing, are more prone to these incidents due to their tendency to explore objects by mouth.[2]

Foreign body aspiration is a medical emergency that poses a high risk of morbidity and mortality rates especially in children, with a peak incidence occurring between the ages of 6 months and 6 years. It ranks as the third most common cause of mortality for infants under the age of one and the fourth most common among people aged one to six.[3,4] According to Tao et al, inhalation of foreign bodies such as food, seeds, or toys can cause asphyxia and suffocation leading to death.[5] Coins are the most commonly ingested foreign objects among children, with reported prevalence rates

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of up to 54%. However, button battery ingestion is increasingly common, accounting for 19% of cases due to the rising use of electronic toys with batteries that can be easily ingested.[6]

Most of the foreign bodies in the digestive tract will pass harmlessly and end up in the feces, but when they lodge in the GI tract, they become dangerous and toxic.[7] However, the lodging of foreign bodies in the respiratory tract is an emergency and fatal. The leading factors to the injuries caused by FB in the aerodigestive tract include children's behavior, anatomical characteristics, and physiological features such as immature swallowing coordination, development of chewing capacity, and higher respiratory rates. It is important to differentiate food impaction from a true foreign body. Food impaction is usually common in the elderly with benign esophageal conditions.[8]

The clinical presentation of foreign body aspiration or ingestion can vary from mild to life-threatening, with intervention depending on factors like patient age, location, symptoms, and time since ingestion.[9,10] Imaging is crucial for diagnosing and managing these cases.[11] Management is influenced by the timing of presentation, foreign body location, and type. Various instruments and techniques are used for FBs removal, with rigid or flexible bronchoscopy under general anesthesia being commonly used for bronchus FBs, and alligator forceps under general anesthesia for esophageal FBs.[9,11,12]

There is a notable knowledge gap regarding the prevalence and management of aero-digestive foreign bodies in Rwanda, hindering our understanding of this issue. Despite the presence of such cases in Rwandan communities and hospitals, no prior studies have been conducted to assess their prevalence or related diagnostic and management techniques. This study addresses this gap by investigating the frequency and management of aero-digestive foreign bodies at Rwanda Military Hospital.

Methodology

Study Design

This was a retrospective study involving the review of all patients who were diagnosed with aero-digestive foreign body at RMH from January 2017 to December 2022, excluding patients presenting with foreign bodies beyond the lower esophageal sphincter and other parts of the body.

Data Collection and Analysis

Data were collected from patient files in the operating room archives and the hospital's OpenClinic system. Collected data included sex, age, region of residency, year of FB diagnosis, nature and type of ingested or aspirated foreign body, site of foreign body lodgment, associated signs and symptoms, diagnostic method used, and management employed. The information was compiled into a Microsoft Excel spreadsheet and subsequently exported to SPSS version 23 for statistical analysis. Descriptive statistics, including numerical calculations, graphs, and tables, were employed to summarize the data and determine the prevalence and management of aero-digestive foreign bodies among patients at Rwanda Military Hospital from 2017–2022.

Ethical Consideration

We obtained ethical clearance for this study from the Rwanda Military Hospital Ethical Committee, under reference number: 053/RMH/COMDT/2023. Since the study was a retrospective review of existing records and did not directly involve human subjects, consent forms were not required, and the hospital's ethical committee waived this requirement. However, patient data were kept confidential through anonymization, and measures were taken to ensure that data were not shared with third parties or individuals outside the research team. All data handling adhered to the principles of the Declaration of Helsinki, ensuring compliance with established ethical standards.

Results

Gender and Age of Participants

In the period of six years, from January 2017 to December 2022, a total of 39,240 patients consulted ENT department of Rwanda Military Hospital. Among them, 290 cases (0.74%) were emergencies related to aerodigestive foreign bodies. Of these cases, 166 (57.24%) were male, and 124 (42.76%) were female. Out of 290 cases at Rwanda Military Hospital's ENT department, toddlers (1–3 years) had the highest prevalence of aerodigestive foreign bodies with 146 cases

Table 1 Age Distribution of Aerodigestive Foreign Body Cases at RMH, 2017–2022

Age Group	Age Group	Sex		
		Female	Male	Grand Total
0 months −1 year	Infants	6 (2.07%)	5 (1.72%)	11 (3.79%)
1 year- 3 years	Toddlers	55 (18.97%)	91 (31.38%)	146 (50.34%)
3 years −5 years	Preschoolers	32 (11.03%)	44 (15.17%)	76 (26.21%)
5 years- 12 years	School-Aged	24 (8.28%)	17 (5.86%)	41 (14.14%)
12 years- 18 years	Adolescents	0 (0.00%)	2 (0.69%)	2 (0.69%)
Above 18 years	Adults	7 (2.41%)	7 (2.41%)	14 (4.83%)
Grand Total		124 (42.76%)	166 (57.24%)	290 (100.00%)

(50.34%), followed by preschoolers (3–5 years) at 76 cases (26.21%), and school-aged children (5–12 years) at 41 cases (14.14%). Infants (1 month-1 year) accounted for 11 cases (3.79%), adults (18+ years) for 14 cases (4.83%), and adolescents (12–18 years) for just 2 cases (0.69%). Males predominated at 57.24% (Table 1).

Region of Residency of Participants

Rwanda Military Hospital documented a substantial number of aerodigestive foreign body cases across various regions. The Eastern province accounted for the highest prevalence, representing 73.10% of total cases, followed by Kigali city at 22.76%. Conversely, the North province reported only 2.41% of cases, with the West and South provinces recording even lower incidences at 1.03% and 0.69%, respectively (Figure 1). This uneven distribution is due that Eastern province and Kigali city are main catchment areas for Rwanda Military Hospital.

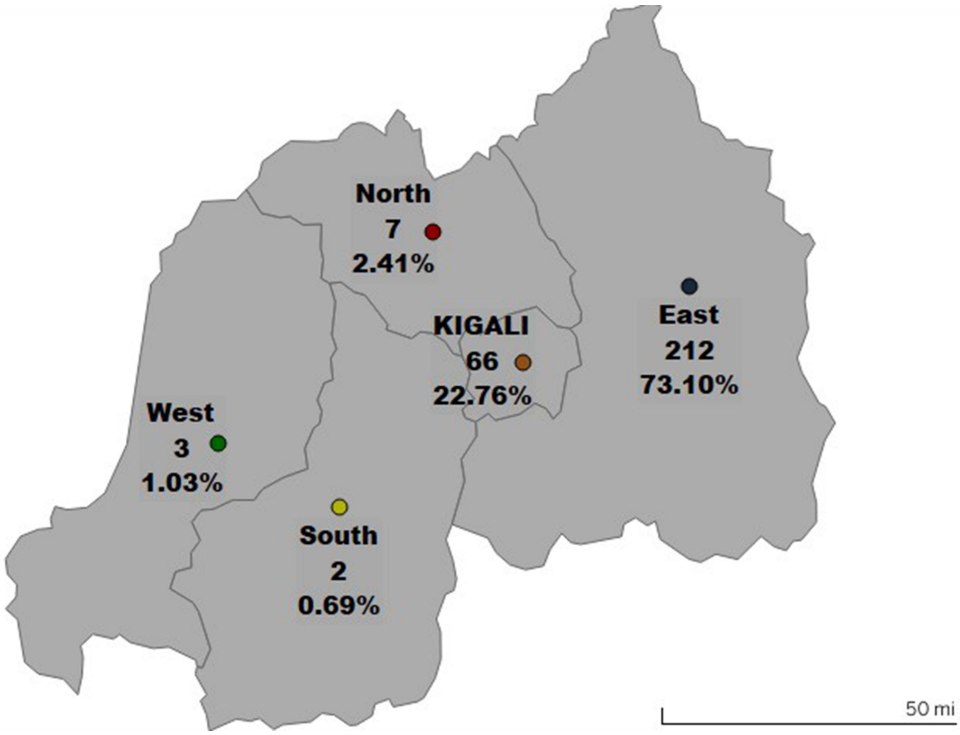

Figure 1 Region distribution of aerodigestive foreign body cases at RMH, 2017–2022.

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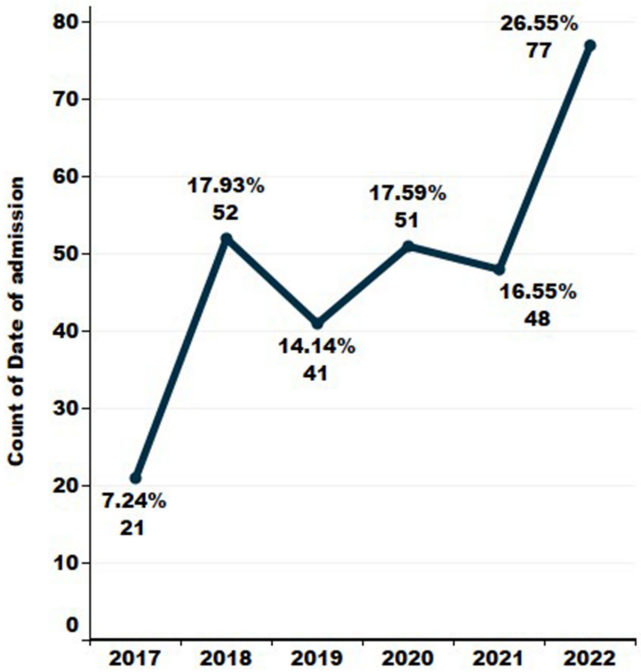

Figure 2 Distribution of year of diagnosis of aerodigestive foreign body cases at RMH, 2017–2022.

Year of Consultation for Aerodigestive Foreign Body Patients at RMH, 2017-2022

The data on aerodigestive foreign body cases at RMH from 2017 to 2022 shows an overall increasing trend, with notable fluctuations. The number of cases rose from 21 (7.24%) in 2017 to a peak of 77 (26.55%) in 2022, with significant increases in 2018 and 2022, and slight decreases in 2019 and 2021 (Figure 2). This upward trend underscores the growing prevalence of such cases over years.

Nature and Type of Foreign Body

During the extensive 6-year study conducted at Rwanda Military Hospital, the analysis of aerodigestive foreign body cases within the ENT department unveiled a notable prevalence of inorganic objects, which constituted the majority of cases (68.97%). Among these, coins emerged as the most frequently encountered foreign bodies, comprising 35.17% of the total count, followed by unspecified items at 14.48% and stones at 3.45%. The range of inorganic items varied widely, encompassing plastic pieces, pen covers, button batteries, and more. Conversely, organic foreign bodies, while present, represented a smaller proportion of cases (31.03%), with seeds being the predominant type at 25.17% (Table 2).

Table 2 Distribution of Nature and Types of Foreign Body in Aerodigestive Foreign Bodies in ENT

Nature of the Specimen	Types of Foreign Body	Count	Percentage
Inorganic	Coin	102	35.17%
	Unspecific	42	14.48%
	Stone	10	3.45%
	Plastic piece	7	2.41%
	Pen covers	7	2.41%
	Button batteries	6	2.07%

(*Continued*)

Table 2 (Continued).

Nature of the Specimen	Types of Foreign Body	Count	Percentage
	Bottle cap	6	2.07%
	Piece of sponge	5	1.72%
	Bead	5	1.72%
	Metal object	2	0.69%
	Cloth buttons	2	0.69%
	Wood piece	1	0.34%
	Pins	1	0.34%
	Piece of soap	1	0.34%
	Pearl	1	0.34%
	Magnet	1	0.34%
	Key holder	1	0.34%
	Total	200	68.97%
Organic	Seed	73	25.17%
	Bone	8	2.76%
	Maize	4	1.38%
	Peanut	1	0.34%
	Insect	1	0.34%
	Food material	1	0.34%
	Corn	1	0.34%
	Bean	1	0.34%
	Total	90	31.03%
Grand Total		290	100.00%

Signs and Symptoms of Patients Diagnosed with Aerodigestive Foreign Bodies

The prevalence of aerodigestive foreign bodies in the ENT department revealed diverse symptoms, with 46.21% of cases being asymptomatic. Common symptoms included drooling (17.93%), dysphagia (9.66%), vomiting (9.66%), and cough (6.21%). Less frequent symptoms were purulent nasal discharge (3.79%), nose pain (0.69%), rhinorrhea (0.69%), and nose swelling (0.34%). Critical symptoms included respiratory distress (7.59%), dyspnea (6.55%), choking (3.45%), and respiratory arrest (0.34%). Rare but serious symptoms were stridor (1.38%), hemoptysis (0.69%), and neck pain (0.34%) (Table 3).

Table 3 Distribution of Signs and Symptoms in Aerodigestive Foreign Body Patients

	Count	Percentage		Count	Percentage
Asymptomatic			Rhinorrhea		
No	156	53.79%	No	288	99.31%
Yes	134	46.21%	Yes	2	0.69%

(*Continued*)

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Table 3 (Continued).

	Count	Percentage		Count	Percentage
Neck Pain			Stridor		
No	289	99.66%	No	286	98.62%
Yes	1	0.34%	Yes	4	1.38%
Hemoptysis			Swelling Of the Palate		
No	288	99.31%	No	289	99.66%
Yes	2	0.69%	Yes	1	0.34%
Nose Bleeding			Wheezing		
No	287	98.97%	No	284	97.93%
Yes	3	1.03%	Yes	6	2.07%
Nose pain			Vomiting		
No	288	99.31%	No	262	90.34%
Yes	2	0.69%	Yes	28	9.66%
Nose swelling			Cough		
No	289	99.66%	No	272	93.79%
Yes	1	0.34%	Yes	18	6.21%
Odynophagia			Difficulty in breastfeeding		
No	276	95.17%	No	286	98.62%
Yes	14	4.83%	Yes	4	1.38%
Purulent Nasal Discharge			Drooling		
No	279	96.21%	No	238	82.07%
Yes	11	3.79%	Yes	52	17.93%
Respiratory Arrest			Dysphagia		
No	289	99.66%	No	262	90.34%
Yes	1	0.34%	Yes	28	9.66%
Respiratory distress			Dyspnea		
No	268	92.41%	No	271	93.45%
Yes	22	7.59%	Yes	19	6.55%
Chocking			Fever		
No	280	96.55%	No	286	98.62%
Yes	10	3.45%	Yes	4	1.38%
Restlessness			Foul Smelling		
No	289	99.66%	No	286	98.62%
Yes	1	0.34%	Yes	4	1.38%

Type of Investigations

Chest X-rays emerged as the most frequently utilized investigation, accounting for 49.66% of cases, followed by Rhinoscopy at 35.52%. Intriguingly, a considerable proportion of patients (11.38%) did not undergo any specific investigation. A combination of Chest X-rays with CT scans and Abdominal X-rays constituted a minor percentage of cases (1.03% each), while Esophagoscopy, Endoscopy, CT scans, and Abdominal X-rays were employed in minimal instances (0.34% each) (Table 4).

Site of Lodgment of Foreign Bodies

When considering the mouth as the entry point, the esophagus was identified as the most common site of foreign body lodgment, occurring in 96 cases (33.10%). This was followed by the pharynx (12.07%), bronchus (8.28%), trachea (2.41%), tonsillar region (1.38%), and bronchioles (0.34%). In contrast, when the nose was the entry point, the nostrils were the predominant site of lodgment, observed in 85 cases (29.31%). Additional sites included the nasal cavity (10.69%), bronchus (1.38%), trachea (0.69%), and tonsillar region (0.34%) (Table 5).

Table 4 Distribution of Investigations Done in Aerodigestive Foreign Bodies in ENT in RMH

Investigations Done	Count	Percentage
Chest X-ray	144	49.66%
Rhinoscopy	103	35.52%
None	33	11.38%
Chest X-ray; CT scan	3	1.03%
Chest X-ray; Abdominal X-ray	3	1.03%
Esophagoscopy	1	0.34%
Endoscopy	1	0.34%
CT scan	1	0.34%
Abdominal X-ray	1	0.34%

Table 5 Distribution of Site of Lodgment Based on Area of Entry

Area of Entry	Site of Lodgment	Count	Percentage
Mouth	Esophagus	96	33.10%
	Pharynx	35	12.07%
	Bronchus	24	8.28%
	Trachea	7	2.41%
	Tonsillar region	4	1.38%
	Bronchioles	1	0.34%
	Total	167	57.59%
Nose	Nostrils	85	29.31%
	Nasal cavity	31	10.69%
	Bronchus	4	1.38%
	Trachea	2	0.69%
	Tonsillar region	1	0.34%
	Total	123	42.41%
Grand Total		290	100.00%

Management Techniques

Esophagoscopy was the predominant method for managing aerodigestive foreign bodies, addressing cases lodged in the esophagus in 45.52% of cases. Bronchoscopy was the second most frequently used intervention, primarily for foreign bodies in the bronchus, accounting for 13.10% of cases. Forceps were employed in 34.14% of cases, mainly for foreign bodies in the nostrils. Hooks and laryngoscopy were used less often, with hooks addressing 6.21% and laryngoscopy 0.34% of cases. Rhinoscopy was the least utilized, managing only 0.69% of cases (Table 6).

Table 6 Distribution of Mode of Management Based on Site of Lodgment in Aerodigestive Foreign Bodies

Mode of Management	Site of Lodgment	Count	Percentage
Bronchoscopy	Bronchus	28	9.66%
	Trachea	9	3.10%
	Bronchioles	1	0.34%
	Total	38	13.10%
Esophagoscopy	Esophagus	96	33.10%
	Pharynx	35	12.07%
	Tonsillar region	1	0.34%
	Total	132	45.52%
Forceps	Nostrils	75	25.86%
	Nasal cavity	21	7.24%
	Tonsillar region	3	1.03%
	Total	99	34.14%
Hook	Nostrils	10	3.45%
	Nasal cavity	8	2.76%
	Total	18	6.21%
Laryngoscopy	Tonsillar region	1	0.34%
	Total	1	0.34%
Rhinoscopy	Nasal cavity	2	0.69%
	Total	2	0.69%

Discussion

This retrospective study analyzed 290 cases of aerodigestive foreign bodies at Rwanda Military Hospital between 2017 and 2022. Predominantly affecting males and toddlers, cases were most frequent in the Eastern province and Kigali city. Inorganic foreign bodies, particularly coins, were more prevalent than organic ones. Clinical presentations varied, with many cases being asymptomatic, while others exhibited drooling and dysphagia. Chest X-rays were the primary diagnostic modality, and esophagoscopy was the principal management approach for esophageal cases. Additionally, bronchoscopy and forceps were notably utilized for bronchial and nasal foreign bodies, respectively.

In the affected patients, the male-to-female ratio was 1.3:1. This finding aligns with Adeoye P et al[13] in Ilorin, Nigeria, who reported a ratio of 1.6:1, as well as Rijal K et al[7] in Nepal with a ratio of 1.1:1, Nakku D et al[14] in South Western Uganda with a ratio of 2:1, and Navia-López L et al[15] in Mexico who found the ratio of 1.5:1. Our literature search did not reveal a documented female preponderance, and the reason for male predominance remains unclear, though it is sometimes attributed to the more adventurous and impulsive nature of males compared to females.

The incidence of aerodigestive foreign bodies had a frequent occurrence among toddlers (1–3 years). Our results were in concordance with the results obtained by Alabi BS et al in Nigeria with the majority (76.5%) being between 9 months and 4 years,[16] and Higo R et al with 67.7% being in the age group of 1–4 years old.[17] The high incidence in this age group may be attributed to several factors, including behavioral tendencies, and developmental and anatomical characteristics, such as the initiation of chewing habits and incomplete development of swallowing coordination.

Given that our study was conducted in a referral hospital primarily receiving patients from other hospitals, the Eastern Province exhibited the highest prevalence of aerodigestive foreign body cases at 73.10%, followed by Kigali City at 22.76%, the Northern Province at 2.41%, and the Western and Southern Provinces at 1.03% and 0.69%, respectively. These results underscore a significant concentration of cases in regions served by the Rwanda Military Hospital, particularly the Eastern Province and Kigali City. The data from 2017 to 2022 reveal an overall increasing trend in cases, with notable peaks in 2018 and 2022. This rise could be due to factors such as population growth, improved reporting, or increased incidence, emphasizing the need for targeted interventions and further research to address regional disparities and manage rising case numbers effectively.

While the present study revealed that the majority (68.97%) of aerodigestive foreign bodies cases were inorganic objects, coins emerged as the most frequently encountered foreign bodies among all, comprising 35.17% of the total count. Conversely, among organic foreign bodies, seeds were the predominant type at 25.17%. This is in concordance with the studies of Gupta R et al,[18] Bajaj N et al,[19] Alabi B et al[16] as well as Navia-Lopez L et al[15] who all found that coins were the most prevalent aerodigestive foreign body in their respective study settings. However, this finding contradicts the report put forward by Adeoye P et al,[13] who found dentures to be the most common, and that of Kirfi A et al[20] who found metallic objects to be the most common. Reason for these differences could be attributed to differences study populations and other settings. Signs and symptoms of patients with aerodigestive foreign bodies in this study are also common and were observed in other studies.[15,21] Additionally, the lodgment areas, diagnostic methods, and management techniques observed in this study are consistent with those reported in other studies.[14,18,21]

Button battery ingestion has emerged as a significant public health issue, with recent studies documenting its rising prevalence among pediatric patients, primarily due to the increasing availability of electronic toys and devices. In the present study, button batteries were responsible for 2.07% of foreign body ingestion cases. From 1999 to 2019, the United States National Poison Data System recorded a 66.7% increase in the annual incidence of button battery ingestion, rising from 6.98 to 10.46 per million population, alongside a tenfold increase in complications.[22] Research suggests that the proportion of children affected by button battery ingestion ranges from 7% to 25%, particularly among those under six years old, with the highest risk observed at approximately one year of age.[23] Ingesting button batteries poses severe risks, with 26% of cases resulting in esophageal burns, while 23% lead to extreme injuries, including perforation into the trachea.[24]

In this study, a total of 37 cases of tracheobronchial foreign bodies were documented. Among these, 7 were lodged in the trachea and 24 in the bronchus via the oral route, while 2 cases involved the trachea and 4 the bronchus through the nasal route. Tracheobronchial foreign bodies present unique challenges due to their potentially lethal consequences.[25,26] These foreign bodies often obstruct the airway, leading to respiratory distress, persistent coughing, or cyanosis, and in severe cases, asphyxiation and death.[25,27] The management of such cases requires immediate bronchoscopy, which serves both diagnostic and therapeutic purposes. Studies have highlighted that delayed diagnosis can lead to complications such as bronchiectasis, recurrent pneumonia, or even irreversible lung damage.[28,29] In the current study, although tracheobronchial foreign bodies were less common than esophageal or nostrils cases, their presence underscores the need for heightened vigilance and rapid intervention.

Based on the findings, several recommendations are proposed to enhance the prevention, management, and outcomes of aerodigestive foreign body cases. First, targeted public awareness campaigns should educate parents, caregivers and the general population about the risks associated with aerodigestive foreign bodies, emphasizing supervision, safe environment, and prompt medical attention. Second, exploring digital currency to reduce coin ingestion risks and promoting use of alternative materials or designs that make foreign bodies less attractive to children can enhance safety. Third, fostering multidisciplinary collaboration among healthcare providers and developing standardized protocols could improve care. Finally, continued research and surveillance should be supported to understand trends and evaluate prevention strategies, informing policy and resource allocation to reduce healthcare burdens.

Conclusion

In Rwanda, aerodigestive foreign bodies, particularly coins, are frequently encountered, predominantly among young children, with a higher incidence in males. This notable prevalence highlights the urgent need for targeted preventive strategies and educational programs to reduce such cases. Tracheobronchial foreign bodies warrant special attention due

to their potential to obstruct the airway, posing a severe threat and risk of mortality if not promptly managed. Public awareness campaigns and enhanced safety measures are essential to address the risks associated with foreign body ingestion and aspiration in children. Effectively implementing these interventions can significantly reduce the incidence of aerodigestive foreign bodies and improve child safety and health outcomes.

Data Sharing Statement

Data are available from the corresponding author on reasonable request.

Ethical Approval Statement

Ethical approval was obtained from Rwanda Military Hospital Ethical Committee.

Disclosure

The authors report no conflicts of interest in this work.

References

1. Hatgaonkar A, Hatgaonkar, K, Dhote S, et al. "Few incidentally found interesting foreign objects in human body: a case series" [Online].Available from: https://f1000research.com/articles/12-1306/v3. Accessed August 16, 2024.
2. Mathew RP, Liang TI-H, Kabeer A, Patel V, Low G. Clinical presentation, diagnosis and management of aerodigestive tract foreign bodies in the paediatric population: part 2. *South African J Radiol*. 2021;25(1). doi:10.4102/sajr.v25i1.2027
3. Ikenberry SO, Jue TL, Anderson MA, ASGE Standards of Practice Committee et al. Management of ingested foreign bodies and food impactions. *Gastrointest Endosc*. 2011;73(6):1085–1091. doi:10.1016/j.gie.2010.11.010
4. Dongol K, Neupane Y, Das Dutta H, Raj Gyawali B, Kharel B. Prevalence of foreign body aspiration in children in a tertiary care hospital. *JNMA J Nepal Med Assoc*. 2021;59(234):111–115. doi:10.31729/jnma.5393
5. Tao X, et al. Cotton ball aspiration leading to pulmonary complications in a child. *Am J Case Rep*. 2024;25:e943957–1–e943957–5. doi:10.12659/AJCR.943957
6. Habib M, Arif K, Chaudhary MA. Characteristics and outcomes of aerodigestive foreign bodies in children. *J Ayub Med Coll Abbottabad*. 2023;35:S726–S731. (Suppl 1), no. 4. doi:10.55519/JAMC-S4-12199
7. Rijal KC, Koirala KP, Khadgi A. Surgical procedure among patients with foreign body obstruction in food passage in a tertiary care hospital: a descriptive cross-sectional study. *JNMA J Nepal Med Assoc*. 2021;59(237):460–463. doi:10.31729/jnma.5704
8. Flint PW, Haughey BH, Lund VJ, et al., Cummings Otolaryngology [Online]. 2020. Available from: https://shop.elsevier.com/books/cummings-otolaryngology/flint/978-0-323-61179-4. Accessed: August 16, 2024.
9. Lowe E, Soylu E, Deekonda P, et al. Principal diagnostic features of paediatric foreign body aspiration. *Int J Pediatric Otorhinolaryngol*. 2024;177:111846. doi:10.1016/j.ijporl.2023.111846
10. Molla YD, Mekonnen DC, Beza AD, Alemu HT, Selamawi AE. Foreign body aspiration in children at University of Gondar Comprehensive Specialized Hospital, a two year retrospective study. *Heliyon*. 2023;9(10):e21128. doi:10.1016/j.heliyon.2023.e21128
11. Salih Q. "Foreign body aspiration in children: clinical, radiological and bronchoscopy findings | Duhok medical journal" [Online]. Available from: https://dmj.uod.ac/index.php/dmj/article/view/297. Accessed August 16, 2024.
12. El Omri M, Naouar M, Bellakhdher M, et al. Unusual tracheobronchial foreign bodies: clinical presentation and management in adults. *Egypt J Ear Nose Throat Allied Sci*. 2024;25(25):1–4. doi:10.21608/ejentas.2024.253680.1698
13. Adeoye PO, Abdulrahman Afolabi O, Kayodele Omokanye H, et al. Foreign bodies in the aerodigestive tract: time for comprehensive preventive measures. *Afr Health Sci*. 2022;22(2):369–376. doi:10.4314/ahs.v22i2.42
14. Nakku D, Byaruhanga R, Bajunirwe F, Kyamwanga IT. A case control study of the factors associated with occurrence of aerodigestive foreign bodies in children in a regional referral hospital in South Western Uganda. *BMC Ear Nose Throat Disord*. 2016;16:5. doi:10.1186/s12901-016-0026-4
15. Navia-López LA, Cadena-León JF, Ignorosa-Arellano KR, et al. Foreign body ingestion and associated factors in pediatric patients at a tertiary care center. *Revista de Gastroenterología de México*. 2022;87(1):20–28. doi:10.1016/j.rgmxen.2021.09.004
16. Omokanye H. "Foreign bodies in the upper aerodigestive tract of Nigerian children" [Online]. Available from: https://www.academia.edu/105824670/Foreign_Bodies_in_the_Upper_Aerodigestive_Tract_of_Nigerian_Children. Accessed August 16, 2024.
17. Higo R, Matsumoto Y, Ichimura K, Kaga K. Foreign bodies in the aerodigestive tract in pediatric patients. *Auris Nasus Larynx*. 2003;30(4):397–401. doi:10.1016/s0385-8146(03)00087-7
18. Gupta R, Poorey VK. Incidence of foreign bodies in aerodigestive tract in Vindhya region: our experience. *Indian J Otolaryngol Head Neck Surg*. 2014;66(2):135–141. doi:10.1007/s12070-013-0644-8
19. Bajaj N. "Incidence and management of foreign bodies in aerodigestive tract in a tertiary level | international journal of medical research and review" [Online]. Available from: https://ijmrr.medresearch.in/index.php/ijmrr/article/view/1072. Accessed August 16, 2024.
20. Kirfi A. "Clinical profile and management of aerodigestive foreign bodies in North-western Nigeria" [Online]. *Sudan Medical Monitor*; 2014. Available from: https://www.academia.edu/92568723/Clinical_profile_and_management_of_aerodigestive_foreign_bodies_in_North_western_Nigeria. Accessed August 16, 2024.
21. Sahni D, Kaur R, Chanania G, Aggarwal S, Bhagat S. "Prevalence and management of foreign bodies in aerodigestive tract in tertiary care centre" [Online]. 2021. Available from: https://www.semanticscholar.org/paper/Prevalence-and-management-of-foreign-bodies-in-in-Sahni-Kaur/5068670f4433b05f948672de609d3fa6a7216000. Accessed August 16, 2024.

22. Zipursky AR, Ratnapalan S. Button battery ingestions in children. *CMAJ*. 2021;193(38):E1498. doi:10.1503/cmaj.210572
23. Mubarak A, Benninga MA, Broekaert I, et al. Diagnosis, management, and prevention of button battery ingestion in childhood: a European society for paediatric gastroenterology hepatology and nutrition position paper. *J Pediatr Gastroenterol Nutr*. 2021;73(1):129–136. doi:10.1097/MPG.0000000000003048
24. Tran C, Nunez C, Eslick GD, Barker R, Elliott EJ. Complications of button battery ingestion or insertion in children: a systematic review and pooled analysis of individual patient-level data. *World J Pediatr*. 2024;20(10):1017–1028. doi:10.1007/s12519-024-00833-y
25. Kaushal D, Goyal A, Soni K, et al. Challenges in management of tracheobronchial foreign bodies with delayed presentation: an institutional experience. *Int Arch Otorhinolaryngol*. 2021;26(1):e005–e009. doi:10.1055/s-0040-1718964
26. Patigaroo SA, Mehfooz N, Shafi OM, Qazi SM, Ahmad R. Pediatric airway foreign bodies and their management by rigid bronchoscopy: how i experienced. *Indian J Otolaryngol Head Neck Surg*. 2022;74(Suppl 3):6422–6437. doi:10.1007/s12070-020-01868-z
27. Baram A, Sherzad H, Saeed S, Kakamad FH, Hamawandi AMH. Tracheobronchial foreign bodies in children: the role of emergency rigid bronchoscopy. *Glob Pediatr Health*. 2017;4:2333794X17743663. doi:10.1177/2333794X17743663
28. Saquib Mallick M, Rauf Khan A, Al-Bassam A. Late presentation of tracheobronchial foreign body aspiration in children. *J Trop Pediatr*. 2005;51(3):145–148. doi:10.1093/tropej/fmh103
29. Soysal O, Kuzucu A, Ulutas H. Tracheobronchial foreign body aspiration: a continuing challenge. *Otolaryngol - Head Neck Surg*. 2006;135(2):223–226. doi:10.1016/j.otohns.2005.09.035