



ENTANGLED PATHWAYS: CLINICOTHERAPEUTIC STUDY OF AERODIGESTIVE TRACT FOREIGN BODIES

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ABSTRACT

Objectives: To evaluate the types of foreign bodies in the aerodigestive tract, demographic profiles of affected patients, clinical presentations, diagnostic modalities, and management strategies used in a tertiary care center. **Materials And Methods:** A prospective observational study was conducted at the Department of Otorhinolaryngology, Gandhi Medical College & Hamidia Hospital, Bhopal, over 18 months (June 2023–December 2024). A total of 100 patients presenting with suspected or confirmed foreign body ingestion or aspiration were enrolled. Data on demographics, clinical features, investigations, procedures, and complications were analyzed. **Results:** The median age was 5 years, with 54% of cases under 5 years and male predominance (60%). Non-organic foreign bodies were most common (80%). Direct laryngoscopy and esophagoscopy were effective in most ingestion cases, while rigid bronchoscopy was used for aspiration. Successful removal occurred in 89% of cases; 11% were managed conservatively. Complications were reported in 21% of cases, including mucosal injuries (13%) and anesthesia-related events (2%). **Conclusions:** Foreign body ingestion and aspiration, though often asymptomatic, can be life-threatening, especially airway obstructions. Early recognition and prompt intervention are essential. Endoscopy remains the mainstay of management, with most foreign bodies retrievable without surgery.

KEYWORDS

Aerodigestive tract, foreign body, esophagoscopy, bronchoscopy, children, aspiration, ingestion, complications

INTRODUCTION

A foreign body is any endogenous or exogenous substance that is inconsistent to the anatomical structure of the area in which it is found.^[1] The upper aerodigestive tract is most common area for lodgement of foreign body due to its narrowest parts, including the glottis and the cricopharyngeal sphincter. Foreign objects that are swallowed or aspirated may pose issues due to their size, shape, and impaction location.^[2] Although aspiration and ingestion of foreign bodies can occur to anybody at any age, the majority of these incidents occur in children under the age of five. Coins (in children), fish and chicken bones (in adults), and dental prosthesis are frequent causes of foreign body ingestion.^[3,4]

About 80% to 90% of all ingested foreign bodies pass through the digestive tract without the need for intervention, making foreign body ingestion a frequent clinical presentation. Hardly 1% of cases require surgery, and only 10% to 20% require endoscopic removal.^[5] Despite improvements in public awareness and emergency care, mortality due to aspiration is still a leading cause of death for children.^[6,7]

Assessing the patient's size, the type of object ingested, the location of the object, the clinical symptoms, the time lapse between ingestion and seeking care, and a host of other variables is necessary to determine the indications and timing for intervention. Often, opting for endoscopic removal over monitoring alone is the simplest and least stressful course of action.^[8] As per the National Safety Council, asphyxia due to foreign body ingestion and aspiration ranks third among accidental causes of mortality for children under one year old and fourth among children between one and six years old.^[9,10] Compared to adult recommendations, the guidelines available for paediatric patients are lacking as it is difficult to determine which ingested foreign bodies will pass through the digestive tract without the need for intervention due to size variations in paediatric patients. Furthermore, the timing and kind of ingestion is largely unknown in paediatric patients due to the imprecise histories.^[11]

With the above background, this study was conducted to study different types of foreign body aerodigestive tract presenting to department Otorhinolaryngology. We also aimed to evaluate demographic profile of patients of foreign body in aerodigestive tract and different approaches in management of foreign body in aerodigestive tract.

MATERIALS AND METHODS

The present study was conducted as a Prospective Observational Study

on patients presenting to with accidentally ingested foreign bodies & patients suspicious accidentally ingested, aspirated foreign bodies on clinical examinations or investigations at Department of Otorhinolaryngology, Gandhi Medical College & Hamidia Hospital, Bhopal during the study period of 18 months (June 2023 to December 2024).

According to previous studies, foreign bodies were ingested 57.6% [12] At 95% confidence interval-

$$Z=1.96 \text{ So } Z^2=3.84$$

$$p=57.6$$

$$q=(100-p)=42.4$$

$$d(\text{error})=10\%$$

$$\text{Using the formulae } n=Z^2pq/d^2$$

Sample size was estimated to be 94 and thus a total of 100 patients were included in the study.

Selection criteria- Patients presenting to or referred from other departments to Department of Otorhinolaryngology OPD and ward who had accidentally ingested foreign bodies & patients suspicious of accidentally ingested or aspirated foreign bodies on clinical examinations and/or investigations were included whereas patients not willing to participate in study were excluded.

After approval from ethics committee of the institute, the study was initiated. All the patients satisfying inclusion criteria were enrolled and their consent was obtained. Using the proforma, detailed history regarding sociodemographic variables, clinical complaints, past history, personal history and family history was obtained and documented in proforma. All the patients were subjected to general and systemic examination. Further, local examination of ear, nose and throat was done and findings were documented. Depending upon the history, provisional diagnosis was established and patients were subjected to investigations and other special tests such as Xray Soft tissue neck, Chest Xray PA view, Xray abdomen (erect), CT Scan Neck/Chest (in selected cases), FOFE (Flexible Optic Fibro Endoscopy), D/L (Direct Laryngoscopy), Rigid Esophagoscopy (Diagnostic & Therapeutic) and Rigid Bronchoscopy (Diagnostic & Therapeutic).

Statistical Analysis

Data was compiled using MsExcel and analysed using IBM SPSS software version 20. Categorical data was expressed as frequency and percentage whereas continuous data was expressed as mean and SD.

RESULTS

The median age of patients enrolled in our study was 5 years (IQR- 3 to 10 years). We reported male predominance for foreign body aerodigestive tract i.e. 60% cases were males. The majority of cases presented with ingestion of non organic foreign bodies (80%) followed by 14% cases presenting with ingestion of organic foreign body. Clinical examination revealed reduced air entry on left side in 5% cases and on right side in 1% cases. Reduced air entry was associated with tachypnoea in 4% cases. Associated systemic syndromes were present in 2 cases, i.e. 1 case had Down's syndrome and other case had systemic sclerosis. The patient with Down's syndrome had cervical instability and thus, making it difficult to extend the neck while foreign body removal whereas there was reduced mouth opening and loss of teeth in patient of systemic sclerosis, thereby there was difficulty in intubation and endoscopy (Table 1).

Table 2 reveal radiological features in cases with foreign body aerodigestive tract. Chest CT was done in 3 cases only and among them the findings were suggestive of few fibrotic bands in right middle lobe, linear hyperdense opacity and soft tissue density in lumen of left main bronchus in 1 case each.

Direct laryngoscopy was done in 56 cases, of them, foreign body was removed from cricopharynx in 66.1% cases, whereas esophagoscopy was done in 40 cases, and among these cases, foreign body was removed from upper and mid esophagus in 40% cases each, and from GEJ in 5% cases. Bronchoscopy was done in 11 cases and among these cases, foreign body was removed from left primary bronchus in 54.5% cases, right primary bronchus in 18.2% cases, carina in 18.2% cases and left tertiary bronchus in 9.1% cases. Foreign body was removed using 70 degree and FOFB in 4 cases each (Table 3).

Foreign body was removed successfully in 89% cases and 11% cases were kept under observation. They were instructed to monitor their feces for presence of foreign body (Table 4). Complications were observed in 21% cases, most common being procedure related mucosal injury (13%). About 4% cases had charring due to presence of foreign body. 2% cases experienced anaesthesia related postoperative mechanical ventilation. In 2% cases, foreign body could not be retrieved in our department, so assistance from other department was taken (Figure 1).

DISCUSSIONS

We aimed to study different types of foreign body aerodigestive tract presenting to department Otorhinolaryngology and to evaluate demographic profile of patients of foreign body in aerodigestive tract and different approaches in management of foreign body in aerodigestive tract. This study included 100 patients presenting with history of foreign body ingestion or aspiration irrespective of their age and gender. While anybody at any age can aspirate or ingest foreign bodies, children under the age of five account for the majority of these cases.^[3,4]

We included 100 patients belonging to age range of 1 to 72 years and the median age of patients was 5 years (IQR-3 to 10 years) and more than half of patients with foreign body in aerodigestive tract were under 5 children (54%). We reported slight male predominance (60%) for foreign body in aerodigestive tract with male :female ratio of 1.5:1. Children in this age range may also be involved due to their developing coordination in the swallowing process. Young children often have a tendency to place anything they can grasp into their mouths.^[13]

Although majority of patients with foreign bodies in upper aerodigestive tract are asymptomatic, patients may present with wide variety of symptoms, depending upon site of lodgement and type of foreign body.^[14] In the present study, history of foreign body ingestion was present in 94% cases, 80% cases had history of non-organic substance ingestion and 14% cases had history of organic foreign body ingestion. History of aspiration was observed in 6% cases, 5% non-organic and 1% organic. History of dysphagia, choking with coughing, dysphagia with coughing, globus and dysphagia with halitosis was present in 17%, 6%, 2%, 2% and 1% cases respectively. In a study of Tagsa et al, history of ingestion was present in 96% and aspiration was present in 4% cases. Coins (63.5%) and food (18.1%) were the most

common foreign bodies, followed by dentures (11.5%).^[15] Mahmud et al reported that coins was the most common foreign body ingested (67%) and 97.9% ingestions were unintentional. 94% cases with gastric foreign bodies and 56% cases with esophageal foreign bodies were asymptomatic.^[16] Thus, patients with foreign body in aerodigestive tract present with varying symptoms and these symptoms are often vague. The history of ingestion of foreign body is difficult to elicit in cases of children.

On clinical examination, we found no associated findings in 84% cases whereas reduced air entry on left side was observed in 5% and that on right side was present in 1%. We observed foreign body lodgement to be more common in left side, whereas literature suggests right bronchus to be more prone for aspiration due to its anatomy.^[13] On indirect laryngoscopy examination, 6% cases had foreign body, of them 2 cases had foreign body on left vallecula, 1 case each had foreign body on left anterior tonsillar pillar, left pyriform fossa, right pyriform fossa and right vallecula. However, noisy breathing on inspiration was observed in 2% cases. Two patients had associated systemic syndromes: one had systemic sclerosis, and the other had Down syndrome. While patients with systemic sclerosis had restricted mouth opening and tooth loss, which made intubation and endoscopy challenging, patients with Down syndrome experienced cervical instability, which made it difficult to extend the neck during foreign body removal.

The majority of ingested foreign objects easily pass through the digestive system. Therefore, in the majority of instances, conservative therapy through careful monitoring is warranted. Esophagoscopy is commonly used to extract foreign objects from the upper gastrointestinal tract in approximately 10-20% of instances. However, in less than 1 %, surgical procedure may be necessary due to blockage or its potential complications.^[5] The definitive treatment for foreign body impaction in the upper aerodigestive tract involves extraction using rigid and flexible bronchoscopes. Once a diagnosis is established, foreign bodies lodged in the esophagus should be extracted, as they are unlikely to pass naturally. Tracheobronchial foreign bodies should always be treated as emergencies. In situations where endoscopic removal fails, a thoracotomy may be considered. Both flexible and rigid endoscopy have shown high success rates and low complication rates for removing esophageal foreign bodies; however, flexible endoscopy can be performed with local anesthesia and typically takes less time to complete.^[15]

Of 56 patients that underwent direct laryngoscopy, 66.1% resulted in the removal of a foreign body from the cricopharynx; in 33.9% of these cases, direct laryngoscopy was attempted but it was unsuccessful, necessitating esophagoscopy. Out of 40 patients that underwent esophagoscopy, 40% of them had a foreign body removed from the upper and mid-esophagus, and 5% had one removed from the GEJ. After an unsuccessful attempt at esophagoscopy in six patients, further investigations were done. Of the 11 patients that had bronchoscopy endoscopy, 54.5% had a foreign body removed from the left primary bronchus, 18.2% from the right primary bronchus, 18.2% from the carina, and 9.1% from the left tertiary bronchus. In four cases each, the foreign body was removed using 70 degrees and FOFB.

89% of the foreign bodies in the current research were effectively removed, while 11% were placed under observation and instructed to periodically examine their stools for the presence of foreign bodies. Coins accounted for 52% of all foreign bodies that were retrieved. Our study findings were also supported by the findings of Mir et al, in which coins were the most common foreign body retrieved and majority of foreign bodies passed spontaneously.^[8] Kinjalk et al retrieved 74.7% of foreign bodies conservatively and out of 99 patients, endoscopic removal was done in 21 cases and surgery was done in 3 cases.^[11] In a study of Mahmud et al, within 24 hours of ingestion, around 80% of button batteries and 77.8% of pointed items were successfully removed from the body. Likewise, following the 24-hour period, 98.6% and 100%, respectively, of the blunt items and food impaction were effectively eliminated. In 99 percent of the instances, endoscopic removal was effective.^[16]

Complications were assessed with respect to foreign body itself, procedure related and anaesthesia related. Charring due to foreign body was observed in 4% cases, mucosal injury due to procedure was noted in 13% cases whereas anaesthesia related complication i.e. post operative mechanical ventilation was noted in 2% cases. In another 2%

cases we took assistance from other department to remove foreign bodies. Taggsa et al documented esophageal mucosal abrasions in 6% paediatric cases and 53% adult cases and esophageal mucosal lacerations were observed in two instances. The authors also documented esophageal perforation as a result of wire ingestion in 1 case and this case was managed with the help of thoracovascular surgeon.^[15] Mahmud et al found a significant association of complications such as erythema, bleeding, erosion and ulceration with increased length of impaction in cases of ingestion of button batteries and sharp items.^[16]

The limitations of our study are, first the study was conducted as a facility-based study involving single centre and thus the population may be homogenous due to regional and cultural practises. Also, the sample size of the study was small. However, a multicentric study with large sample size is warranted to confirm or refute the findings of present study. In our study, we found no significant impact of confounding factors on complications such as age, gender, time since ingestion or aspiration, type of foreign body etc. Long term complications and morbidity associated with these foreign bodies could not be assessed.

CONCLUSIONS

Foreign bodies in aerodigestive tracts are common condition for which the patients seek care in Department of Otorhinolaryngology. Although foreign body aerodigestive tract can be observed in any age and any gender, children (under 5 years) are at highest risk. Although vast majority of patients are asymptomatic, in certain patients foreign bodies like button batteries can be fatal and need immediate treatment. Patients may presents with varying clinical features depending upon the type of foreign body and site of impaction. In case of foreign body ingestion, dysphagia is more common whereas in cases with aspiration, coughing is common presentation. Diagnosis was established based upon clinical history and examination, supported by X-ray and in some cases CT scan. Almost all the ingested foreign bodies were retrieved successfully by direct laryngoscopy and esophagoscopy whereas almost all the aspirated foreign bodies were retrieved by rigid bronchoscopy and FOFB. However, few foreign bodies did not require any intervention and expel spontaneously whereas surgical removal is warranted in few cases. Although most of the time foreign body ingestion is asymptomatic but airway foreign body needs immediate care as it could be life threatening and there may be initial asymptomatic period followed by recurrent episodes of broncho pneumonia in which one should have high index of suspicion about old foreign body and should undergo CT and diagnostic bronchoscopy. Complications, although rare, are also reported, which could be due to foreign body itself (charring), or may be associated with general anaesthesia or procedure.

Table 1- Distribution Of Patients According To Baseline Variables

Baseline variables			No. of patients (n=100)	Percent age
Age (years)	0-5 years		54	54.0
	6-10 years		23	23.0
	11-15 years		8	8.0
	16-20 years		3	3.0
	>20 years		12	12.0
Gender	Male		60	60.0
	Female		40	40.0
Presenting complaints	Dysphagia		17	17.0
	Choking, coughing		6	6.0
	Dysphagia, Coughing		2	2.0
	Dysphagia, halitosis		1	1.0
	Globus		2	2.0
	Asymptomatic		72	72.0
Clinical history	Aspiration	Non organic	5	5.0
		Organic	1	1.0
	Ingestion	Non organic	80	80.0
		Organic	14	14.0
Clinical examination	Air entry reduced	On left side	5	5.0
		On right side	1	1.0
	Noisy breathing on inspiration		2	2.0
	Foreign body seen on indirect laryngoscopy examination		6	6.0
	Associated systemic syndromes		2	2.0

	Within normal limits	84	84.0
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Table 2- Distribution Of Patients According To Findings Of Radiological Examination

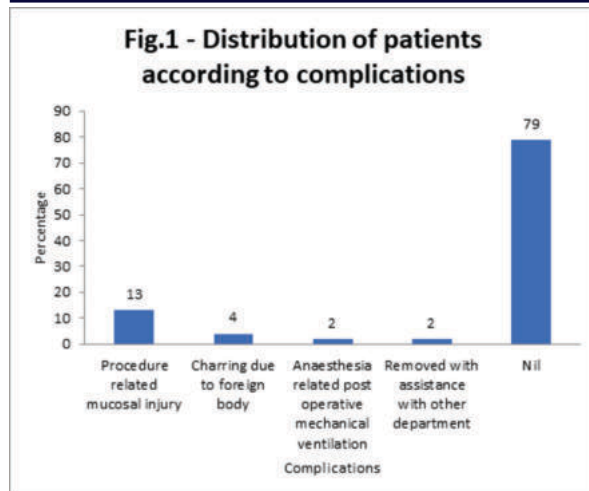
Radiological Examination		No. of patients (n=100)	Percentage
Xray Soft tissue neck AP view	Circular opacity	41	41.0
	Circular opacity with double rim	2	2.0
	Linear opacity	2	2.0
	Ill defined opacity	3	3.0
	Shadow	7	7.0
Xray Soft tissue neck lateral view	WNL	45	45.0
	Opacity at C6	42	42.0
Chest X ray PA view (Shape)	WNL	58	58.0
	Circular opacity	12	12.0
	Linear opacity	3	3.0
	Ill defined opacity	3	3.0
	Shadow	4	4.0
	Left lung collapse	2	2.0
	Left lung hyperinflation	1	1.0
	WNL	75	75.0
Chest X ray PA (site)	At C6	4	4.0
	Upper oesophagus	5	5.0
	Mid oesophagus	13	13.0
Abdomen Xray erect	Circular opacity in bowels	4	4.0
	WNL	96	96.0

Table 3- Distribution According To Findings Of Endoscopy

Endoscopy		No. of patients	Percentage
Direct laryngoscopy (n=56)	Attempted	19	33.9
	Cricopharynx	37	66.1
Esophagoscopy endoscopy (n=40)	Upper oesophagus	16	40
	Mid oesophagus	16	40
	At GEJ	2	5
	Attempted	6	15
Bronchoscopic endoscopy (n=11)	Carina	2	18.2
	Left primary bronchus	6	54.5
	Left tertiary bronchus	1	9.1
	Right primary bronchus	2	18.2
70 Degree/FOFB (n=8)	70 Degree	4	50
	FOFB	4	50

Table 4- Distribution Of Cases According To Outcome And Foreign Body Retrieved

Foreign body retrieved	No. of patients (n=100)	Percentage
Coin	52	52.0
Mutton/ chicken/ fish bone	5	5.0
Pin	4	4.0
Button battery	3	3.0
Metallic toy	2	2.0
Mutton bolus	2	2.0
Peanut	2	2.0
Stone	2	2.0
Whistle	2	2.0
Mango seed	1	1.0
Mucosal plugs	1	1.0
Battery toy	1	1.0
Date palm seeds	1	1.0
Chain	1	1.0
Hair pin	1	1.0
Nail	1	1.0
Nutbolt	1	1.0
Paper pin	1	1.0
Pea	1	1.0
Safety pin	1	1.0
Led bulb	1	1.0
Metal clip	1	1.0
Toy	1	1.0
Wooden piece	1	1.0
Observation	11	11.0



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