

## Management of Aero-Digestive Tract Foreign Bodies

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### ABSTRACT

*Aerodigestive tract foreign bodies (FBs) are commonly encountered in medical practice. Presentation could be as elective or life-threatening emergency. Management can be difficult in some cases. The study aims to evaluate institutional experience with the management of aerodigestive tract FBs. Retrospective records of patients who were managed for aerodigestive tract FBs in our hospital between 2008 and 2018 were collated. Extracted data were entered into Microsoft Excel spreadsheet and analyzed using STATA version 10. Two hundred and twenty-three patients were treated for aerodigestive tract FBs during the study period with male: female (M:F) ratio 1:1.1, age range 6 months to 71 years and median age of 3 years. There were 59 (26.5%) FBs in the digestive tract and 164 (73.5%) FBs in the airway. Common modes of presentations include respiratory distress among patients presenting with foreign body in the airway and dysphagia and odynophagia in those with impacted oesophageal foreign body. Diagnosis and localisation of lower airway FBs were with plain radiograph and occasionally computed tomography while impacted oesophageal dentures were confirmed with dilute barium contrast oesophagogram and rigid oesophagoscopy. All but one FBs were removed, with majority (95%) being via endoscopy. Mortality rate was low (0.45%). The patients in this study presented more commonly with foreign bodies in the airway especially in the paediatric age group. With timely diagnosis and therapeutic interventions including endoscopy and selected open surgeries, successful removal can be achieved with very low mortality.*

**Keywords:** Tracheobronchial, Digestive, Tract, Foreign

### INTRODUCTION

Aerodigestive tract foreign bodies (FBs) are common in children and adults. They may present as ingested or aspirated objects impacting in the nose, pharynx, oesophagus and upper or lower airways. Some authors found out that aerodigestive tract FBs resulted in the death of 3000-4100 people per year.<sup>1,2</sup> In the lower airway, location of a foreign body in the right or left main bronchus depends on the patient's age and physical position at the time of inhalation.<sup>3</sup> The same study documented that the angle made by the main stem bronchi with the trachea is similar until the age of 15 years and that up to this age, FBs are found on either side with equal frequency.<sup>3</sup> Growth and

development after the age of 15 years make the right and left main stem bronchi to be at different angles,<sup>3</sup> with the right mainstem bronchus becoming larger, wider, shorter and more in line with the trachea.<sup>1-3</sup> Therefore, lower airway FBs are more commonly found in the right than the left side of the bronchial tree.<sup>3,6-9</sup> No age or gender is immune to aerodigestive tract FBs; although tracheobronchial tree FBs are commoner in children while oesophageal FBs are commoner in adults.<sup>10</sup> Both organic and non-organic FBs are often aspirated or swallowed, and may or not be visualised with radiologic images.<sup>4,7,10-12</sup> Utilisation of painstaking diagnostic criteria in the domains of clinical history, symptoms, physical examination and radiological findings as studied by Kiyani *et al.* can help to avoid unnecessary surgery in patients with unsubstantiated FB inhalation.<sup>13</sup>

Endoscopic removal of aerodigestive tract FBs is the preferred means of treatment, however, when it fails, available options include open surgical removals such as oesophagotomy and thoracotomy/bronchotomy.<sup>7,6,11</sup> Authors have reported

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varying complication rates of endoscopic removal of aerodigestive tract FB to range from 0.4% to 24.7% with such complications including airway oedema and trauma to false cord/laceration of posterior pharyngeal wall.<sup>1,3-6</sup> Mortality figures documented in similar studies also vary from 0-2.4%. Our centre's experience in the management of aerodigestive tract FBs is here reported.

## MATERIALS AND METHODS

This was a retrospective descriptive study of 223 patients who were managed for aerodigestive tract FBs in our hospital between 2008 and 2018. Sources of data were records from theatre, ICU and clinic, and patients' case notes. Data were extracted into proforma on the socio-demographic characteristics, mode of presentation and presenting complaint[s], physical examination findings, diagnosis, investigative modalities that assisted the confirmation of diagnosis, treatment modalities and the outcome of treatment.

Extracted data were entered into Microsoft Excel spreadsheet and analyzed using STATA version 10. Continuous data were presented as means with standard deviation, while categorical variables were presented as frequencies and percentages. Chi-square and Fisher's exact tests were utilized to test associations between variables. The level of statistical significance was set at  $p < 0.05$ .

## RESULTS

Two hundred and twenty-three patients were treated for aerodigestive tract FBs during the study period with male: female ratio 1:1.1, age range from 6 months to 71 years and median age of 3 years. Patients aged less than 18 years of age constituted about 79%, while adults constituted only 21% (Table 1). According to table 2, 73.5% of FBs were in the airway (with 70.4% in the upper airway) while only 26.5% were in the digestive tract. Table 3 shows that there were 59(26.5%) FBs in the digestive tract which included 34 fishbones (15%), 9 dentures (4%),

and 7 coins/metallic objects (3%). Table 4 shows that there were 164(74%) FBs in the airway distributed as 14 (64%) in nose, 3(1.3%) in nasopharynx, 2(0.8%) in hypopharynx, 9(4%) in larynx, 1(0.4%) in trachea, 4(2.2%) in right bronchus and 2(0.8%) in left bronchus. The FBs retrieved from airway included beans, seeds, beads, stones, grain, nuts, coin, steel-ball, nail, thumb pin and toy-part.

One hundred and ten (67%) of 164 patients with FBs in the airway presented with respiratory distress while 57(98%) of 59 patients with impacted oesophageal denture presented with dysphagia and odynophagia. Diagnosis and localisation of FBs in the nose were clinical in all cases, while that of lower airway FBs was with plain radiograph in 87%, computed tomography in 10%, and rigid bronchoscopy in 3%. Impacted oesophageal dentures were confirmed with dilute barium contrast oesophagogram and rigid oesophagoscopy.

As shown in Table 5, about 99% of FBs were removed, with majority (95%) being via endoscopy. Five patients with impacted denture in oesophagus had oesophagotomy for removal via cervical incision (2) and thoracotomy (3). One swallowed office pin was passed out in stool within 34 hours and an impacted piece of meat in oesophagus was pushed into stomach during rigid oesophagoscopy. Of the 6 patients with FBs in bronchus, 5 were successfully removed via rigid bronchoscopy (1) and thoracotomy and bronchotomy (4). One right bronchial FB (steel-ball) slipped back to the carina and into left bronchus intra-operatively. One patient died giving a mortality rate of 0.45%.

As shown in table 5, age group was associated with location of foreign bodies with more children having foreign bodies in the upper (97.5%) and lower (66.7%) while more adults (72.9%) had FB in the digestive tract  $P < 0.001$ . There was no association between sex and location of FBs in this study with  $p = 0.37$ .

Table 1: Age/sex distribution of patients with foreign bodies

Age Group	Male	Female	Frequency	Percent
Children (less than 18 years)	86	90	176	78.9
Adults (18 years and above)	21	26	47	21.1
Total	107	116	223	100
Location of Foreign Bodies				
Upper Airway	70	87	157	70.4
Lower Airway	4	3	7	3.1
Digestive tract (Oesophagus)	33	26	59	26.5
Total	107	116	223	100

The majority (70.4%) of foreign bodies were in the upper airways.

Table 2. Types of foreign bodies in the digestive tract [n=59]

Types of Foreign Body	Frequency	Percent
Fishbone	34	57.6
Denture	9	15.3
Coin/metals	7	11.9
Pin	2	3.4
Meat	1	1.7
Others	6	10.2

The top 3 foreign bodies in the digestive system were fishbone (57.6%), denture (15.3%) and coin/metals (11.9%)

Table 3. Location of foreign body in the upper airway (n=157)

Position	Frequency	Percent
Nose	146	92.8
Larynx	6	3.8
Nasopharynx	3	1.9
Hypopharynx	2	1.3
Which nostril (n=146)		
Right	80	54.8
Left	53	36.2
Both	2	1.4
Not specified	11	7.6

Most (92.8%) of the foreign bodies were lodged in the nostrils. Majority (54.8%) of the FBs are located in the Right nostril

Table 4: Treatment modalities used in patients with aerodigestive tract foreign bodies

Modality	Frequency	Percent
Nasoendoscopy	149	66.8
Laryngoscopy	8	3.6
Oesophagoscopy	54	24.2
Bronchoscopy	2	0.9
Oesophagotomy	Cervical (2) Transthoracic (3)	2.2
Bronchotomy	5 (one failed)	2.2
Total	223 (one patient died after failed removal of right bronchial FB)	100

Table 5: Association between selected factors and location of foreign bodies in the Aerodigestive tracts

Variable	Location of foreign bodies			Total	Statistical test and values
	Upper Airway n (%)	Lower Airway n(%)	Digestive Tract n(%)		
Age groups					
Less than 18	153(97.5)	6(66.7)	16(27.1)	175	P=0.00+
18 and above	4(2.5)	1(33.3)	43(72.9)	48	
Sex					
Males	70(44.6)	4(42.9)	33(55.9)	107	P=0.37+
Females	87(55.4)	3(57.1)	26(44.1)	116	

+ Fishers exact



Figure 1: Antero-postero neck radiograph showing FB in oesophagus



Figure 2: Lateral neck radiograph showing FB in oesophagus



Figure 3: Coin removed from oesophagus

## DISCUSSION

The index study has shown aerodigestive tract foreign bodies to be a common presentation to cardiothoracic and otorhinolaryngologic units as previously documented.<sup>14,15</sup> Children and adults were affected in the present study which also shows that children are much more prone to inhalation of foreign bodies into the airway than adults with a ratio of 32:1. This corroborated the finding in other related studies.<sup>10-12</sup> The median age is 3 years, which is still similar to findings in other studies.<sup>5-10</sup> A similar study found that 96% of airway FBs occurred in children while 67% of oesophageal FBs occurred in adults.<sup>4</sup> The cases of ingestion of denture all occurred in adults. A common observation was that the dentures were poorly fitted on the alveolus before dislodgment, having been in use for many years. The bronchial FBs in this cohort were predominantly on the right which may be explained by the lower airway anatomy. The right bronchus is wider, shorter and almost in a straight line with trachea at the carina, thereby favouring reception of more FB. Similar findings were made by other researchers.<sup>3,6,7,9</sup> The physical position of the patient at the time of aspiration can also determine the bronchus of FB lodgement.<sup>3</sup> A foreign body aspirated while in the lateral decubitus position is more likely to lodge in the bronchus that is dependent if the FB gets down to the bronchus.

The different objects such as bean, nut, bead, toy part, coin, thumb pin, etc, found

variously in the nose and other parts of the airway in children are among the objects commonly available in homes. To prevent their aspiration, care-givers have to ensure that these objects are kept out of the reach of toddlers. Oesophageal FBs such as dentures can be prevented by not wearing any loose-fitted denture. Others like pieces of meat and bone can be prevented through proper eating culture. The findings with regarding the types of FBs corroborated with those of other studies.<sup>4-7,10-12,16,17</sup> There was however no case of aspiration of live insect as was reported by Liu *et al.*<sup>16</sup> In most patients who presented in emergency with respiratory distress and had a clear clinical history to support the diagnosis of aerodigestive tract FB, endoscopy served both the functions of confirmation of diagnosis and treatment when the FB was successfully removed. Metallic FBs were easily diagnosed with plain radiographs and computed tomographic scan was rarely needed for localisation of FBs. However, non-radiopaque FBs in the oesophagus were diagnosed with the use of dilute barium oesophagogram. Dilute barium sulphate was used because of the potential for mediastinitis associated with concentrated barium sulphate in the event of oesophageal perforation. Fishbones were not seen as radio-opaque FBs in all instances. The study of Hariga, *et al.* reported accuracy of plain radiograph diagnosis of only 48.7%.<sup>4</sup>

Successful removal with rigid endoscope was reported in about 95% with <2% procedural complication rate.<sup>4</sup> The same study also noted that in up to 12% of cases of suspected FB ingestion, no FB was found after investigation and endoscopy.<sup>4</sup> In the index study, 5 patients had failure of bronchoscopic localisation and were then operated on via thoracotomy. In the study of Asif, *et al.*, rigid bronchoscopy had a success rate of 97.5% for removal of airway FBs while the remaining patients were referred for thoracotomy.<sup>3</sup> In that study, though there was no mortality, the complication rate was rather high at 24.7% and included airway oedema and trauma to false cord/ laceration of posterior pharyngeal wall. In the index study,

one FB in the right bronchus in a 6-year-old fell back to the carina and dropped into the left bronchus during right thoracotomy in the left lateral position. This was discovered with immediate post-operative chest radiograph after the thoracotomy wound was closed following non-localisation of the FB in the right bronchus intra-operatively. The patient died before repeat attempt at removal of FB, and constituted the only mortality in the study resulting in 0.45% mortality rate. There were no cases of FB removal via tracheostomy though this method has been reported.<sup>18</sup>

Oesophageal FBs were successfully removed endoscopically except in the cases of impacted denture where oesophagotomy was done for 5 patients; 2 via left cervical incision and 3 via right thoracotomy. and there was no case of sudden death which can occur from airway FB.<sup>11,17</sup>

Analysis showed that age group was associated with location of foreign bodies with children (less than 18 years) having foreign bodies in the upper (97.5%) and lower (66.7%) airways, while more adults (72.9%) had FBs in the digestive tract ( $P < 0.001$ ). There was no association between sex and location of FBs in the study. The overall mortality rate was 0.45%. We recommend that if toddlers who explore their environment extensively are closely monitored by adult care-givers, the incidence of aerodigestive tract FBs could reduce significantly.

## CONCLUSION

The patients in this study presented more commonly with foreign bodies in the airway, especially in the paediatric age group. With timely diagnosis and therapeutic interventions including endoscopy and selected open surgeries, successful removal can be achieved with very low mortality.

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