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Research Article

Airway foreign bodies: our six years' experience with 301 cases

Jayalaxmi S. Aihole*, Narendra Babu M., Deepak J., Vinay Jadhav

Department of Paediatric Surgery, IGICH, Bangalore, Karnataka, India

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***Correspondence:**
Dr. Jayalaxmi S Aihole,
E-mail: jayalaxmisaihole@yahoo.com

ABSTRACT

Background: Foreign body aspiration (FBA) is a common problem in children and accounts for an important cause of morbidity and mortality. The main objective of this study was to evaluate the clinico-demographic profile and management of foreign body (FB) aspiration in hospitalized patients.
Methods: This was a retrospective study conducted at Indira Gandhi institute of child health, Bangalore during the period from January to December 2015. All patients who gave a history of FBA or suspected of FB aspiration, those who had recurrent chest infection and who had undergone bronchoscopy were included in the study. Medical records were used for data collection of cases recurrent chest infections. The diagnosis of FBA was made from the documented clinical presentations, physical findings and investigations like chest X ray, CT scan whenever done. The management included rigid bronchoscopy and surgical interventions like tracheotomy, thoracotomy with bronchotomy and thoracoscopic retrieval.
Results: Most of the patients were in the age group between 1 to 3 years 206 (68%). Males were more affected 217 (72%) than females 84 (27.9%). 290 patients (96.3%) presented early (within 7 days of aspiration) with cough and respiratory distress. FBs were found impacted in the right bronchial tree more commonly, 195 (82.2%), followed by left bronchial tree in 30 (12.6%) and in the trachea 8 (3.3%) cases. In failed bronchoscopy cases, other surgical modalities like tracheotomy, laryngotomy, bronchotomy, thoracoscopic retrieval were attempted.
Conclusions: Children of the age group 1-3 years were found most vulnerable for
FB aspiration. FBs were mostly vegetative and were found mostly in the right bronchial tree. Removal of FB by rigid bronchoscopy was safe and effective when patients presented early. Surgical modalities of management like tracheotomy, laryngotomy, bronchotomy were needed in cases of late presentation.

Keywords: Airway, Foreign body, Tracheo bronchial intervention

INTRODUCTION

Foreign body aspiration (FBA) is a common problem in children and accounts for an important cause of morbidity and mortality. It is potentially life threatening event and may also cause chronic lung injury if not properly managed in time.[1-4] The diagnosis and the treatment of the tracheobronchial FBs require awareness about the problem and highest degree of suspicion of signs and symptoms.[5-7] The most important concern is the timely diagnosis and safe and speedy removal of the foreign bodies from the airway.[3,7] The accurate diagnosis may be missed by treating physician because often the initial choking episode is not witnessed and the delayed residual symptoms may mimic other common conditions such as asthma, recurrent pneumonia or upper respiratory infection.[3,8,9] The symptoms and signs produced depend upon the nature, size, location and time since lodgment of the foreign body in the tracheo bronchial tree. A large foreign body occluding the upper airway may lead to

sudden death whereas a small foreign body may get lodged in the bronchial tree, causing less severe symptoms and hence presenting with associated complications. The first bronchoscopic removal of a foreign body from the bronchial tree was done by Gustav Killian (Father of Bronchoscopy) who removed an aspirated pork bone from the bronchus of a 63 year old farmer under local (cocaine) anaesthesia in 1897. Rigid bronchoscopy still remains the gold standard for the removal of foreign bodies from the tracheobronchial tree under direct vision. With the modern bronchoscopic equipment, the needs for surgical interventions like thoracotomy with bronchotomy and lobectomy have been decreased.

METHODS

Medical records of all patients admitted with suspicion and proven history of FBA (foreign body aspiration) and those who underwent bronchoscopy for recurrent chest infections from January 2010 to December 2015 in Indira Gandhi Institute of child health, Bangalore India, were studied retrospectively. The following data was collected, age, sex, availability of history of foreign body aspiration, type and location of the foreign body and radiological findings. All children were evaluated initially by paediatrician with chest X ray. Patients with either a history of foreign body inhalation or a high index of suspicion of foreign body aspiration underwent rigid bronchoscopy under general anesthesia urgently. Rigid storz ventilating bronchoscopes varying in size from 3-6 mm with fibre optic illumination and various kinds of foreign body extraction forceps were used to retrieve the airway FB.

RESULTS

Most of the patients were in the age group between 1 to 3years 206 (68%). Males were more affected 217 (72%) than females 84 (27.9%). 290 patients (96.3%) presented early (within 7 days of aspiration) with cough and respiratory distress. There was late (after 7 days up to 12 years) presentation in 11 (4%) cases with respiratory complications. FB was found to be radio-opaque in 9 (16.6%) cases on chest imaging. Rigid bronchoscopy was attempted in all cases initially and it was successful to remove FBs in 99.6% of cases in patients who presented early. But it failed to remove the FB in 49 (57.6%) of cases when the patients presented late FBs. Most of the FBs were of vegetative nature 216 (91%) and the number of non-vegetative FB was less 21 (8.8%). FBs were found impacted in the right bronchial tree more commonly, 195 (82.2%), followed by left side in 30 (12.6%) cases and in the trachea 8 (3.3%) of cases. In failed bronchoscopy cases, surgical modalities (1.65%) like tracheotomy, laryngotomy, bronchotomy and thoracoscopic retrieval were attempted.

DISCUSSION

There was a male predominance in our study, with male: female ratio being 1.8:1, and similar results have been reported by other authors; the male: female ratio being 1.4:1 and 1.7:1 (Table 1).[1,3,4]

The accurate diagnosis and timely removal of an inhaled foreign body are most important to prevent respiratory sequelae. The rapid fatigue of the cough reflex after the acute choking episode due to adaptation of the surface sensory receptors is followed by an asymptomatic phase that tends to create a false sense of security. Parental negligence, misdiagnosis, lack of suspicion or even undue delay from fellow professionals also contributes significantly to the delay in reaching the hospital.[2,5-7]

Table 1: Relative sex predilections.

Sex	No	%
Male	217	72%
Female	84	27.9%
Total	301	100

Because the children in the vulnerable 1-3 year age group are ambulatory and exploratory in nature, may be out of parental or care takers view during the acute aspiration episode, and moreover there may not be any witness to give the clinical history.[2,4-6] Our analysis of tracheobronchial foreign body confirms the findings of other studies that majority of the children presenting with foreign body aspiration were under the age of 3 years. In our study, children between 1 to 3 years constituted majority with 68% (Table 2). In our series youngest child to have a FB was of 4 months with a peanut.

Table 2: Age wise distributions.

Age	No of cases	%
0-6 Months	10	3.22
7-12 Months	24	7.97
1-3Years	206	68.4
3-5 Years	20	6.6
5-16 Years	41	13.6

In the present study, the most common signs and symptoms were cough, breathlessness, and wheeze and decreased air entry on the affected side (Table 3). The classical diagnostic triad of bronchial foreign body - cough, wheeze and decreased breath sounds - was thus seen in most of the cases and has also been reported by other authors Banerjee et al, Mc Guirt et al and Inglis et al.[2,13,18] These symptoms may mimic intermittent tracheobronchitis, recurrent pneumonia or asthma. Delayed complications associated with retained foreign bodies include pneumonia, obstructive emphysema and bronchiectasis.[5,8,9,11]

Elhassani in 1988, mentioned that the initial symptoms of foreign body inhalation are choking, gagging and coughing while the child is eating or holding an object in the mouth.[19] As the foreign body passes through the vocal cords into the tracheobronchial tree, these symptoms resolve and a relative asymptomatic period intervenes.[14] Later manifestations depend on the nature of the foreign body, its size and site, its effects on the lung distal to it and the stage at which the patient is presented.[17]The Non-vegetative foreign bodies usually present with few symptoms and signs for weeks or months until they become obstructive causing emphysema or atelectasis. Vegetative foreign bodies, on the other hand, absorb water over time and with subsequent swelling rapidly change from partial to complete bronchial obstruction.

Moreover, vegetative foreign bodies cause surrounding tissue reaction leading to chemical bronchitis with fever and chest infection.[11,13,15] In our series vegetative FBs constituted majority with 91.1%. Peanut being the most common with 49.8% incidence, non-vegetative constituted 8.8% (Table 6).

Table 3: Presenting clinical features.

Symptoms			Signs		
	No of cases	% of cases		No of cases	% of cases
Cough	150	49.8	Tachypnea	95	31.5
breathlessness	130	43.1	Stridor	20	6.6
Fever	167	55	Cyanosis	6	1.9
Wheeze	157	52	Breath sounds equal on both sides	11	9.9
Rec chest infection	13	4.3	Breath sounds decreased on affected side	273	91.1
			Rhonchi /Crepitations	30	9.9

Diagnostic imaging plays a variable role in identifying tracheobronchial foreign bodies. Chest X ray was the investigation of choice at presentation and for subsequent follow up. Plain chest X ray films may be inadequate to document a non-radio opaque foreign body unless they are obtained in the expiratory phase. On expiration, air trapping, obstructive emphysema and mediastinal shift may be demonstrated. Additionally, it is important to remember that other pulmonary conditions such as asthma and mucus plugging can mimic the radiographic findings associated with foreign body aspiration.

Table 4: Radiological findings.

Radiological findings	No of cases	% of cases
Collapse	22	7.33
Obstructive emphysema	170	56.47
Pneumonia	50	16.61
Normal	50	16.61
FB Seen	09	2.9
Total	301	

In the present series, 16.61% of the cases had normal chest X-rays while 56% of the cases showed secondary changes on chest X-rays in the form of collapse, obstructive emphysema, mediastinal shift and consolidation (Figure 1A, Table 4). Similar secondary changes on chest X-rays have been reported by other authors Me Guirt et al, (1988) and Hamden et al, (2000).[13,20] Most of the foreign bodies are non-radiopaque and small foreign bodies may cause symptoms but no radiographic signs. Contrast enhanced CT scan was done in patients who presented with chronic symptoms to know the status, nature of FB with associated complications like bronchiectasis (Figure 4 and 5).

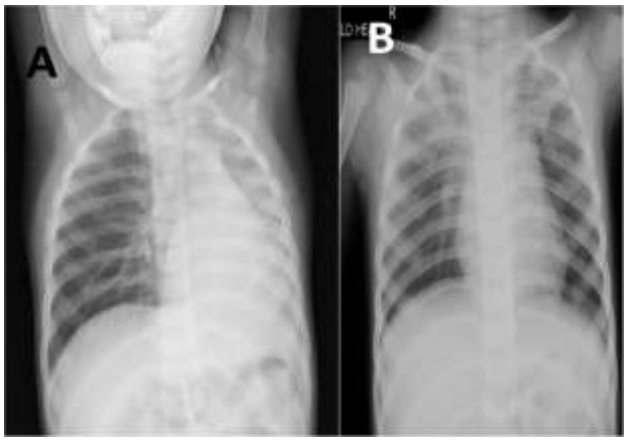

Figure 1 (A): Chest X-ray showing Obstructive emphysema on right side. (B): Chest X ray in patient with a vegetative FB in the trachea with bilateral hyperinflation.

In our series right main bronchus was the most common site of lodgment with 82.2%, whereas 4 cases had bilateral FBs in our series (Table 5). In a study by Banerjee et al, (1988), 66.4% of the removed foreign bodies were of vegetative origin while in a study of Fernandez et al, (2000), 82% of the foreign bodies were

of vegetative origin (Table 6). Similarly in our series also vegetative FBs predominated with 91%. Non-vegetative foreign bodies were less common in our study with 8.8% (Table 6) - a fact also reported by other authors Cohen et al., 1988; Steen and Zimmerman, 1990.[22,23]

Table 5: Relative locations of FBs.

Location of FB	No of cases	% of cases
Trachea	8	3.37
RMB	195	82.27
LMB	30	12.65
Bilateral	04	1.68
Total	237	100

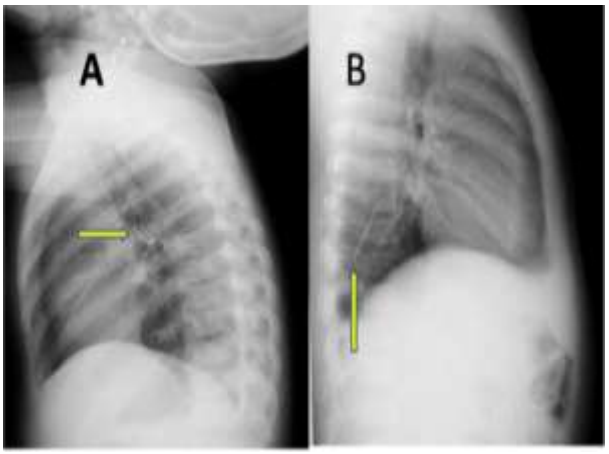

Figure 2 (A): Chest x-ray -Yellow colored arrow indicates LED bulb in the left main bronchus. Figure (B): Chest X-ray-Yellow colored arrow indicates sewing needle migrated into the posterior mediastinum from bronchus.

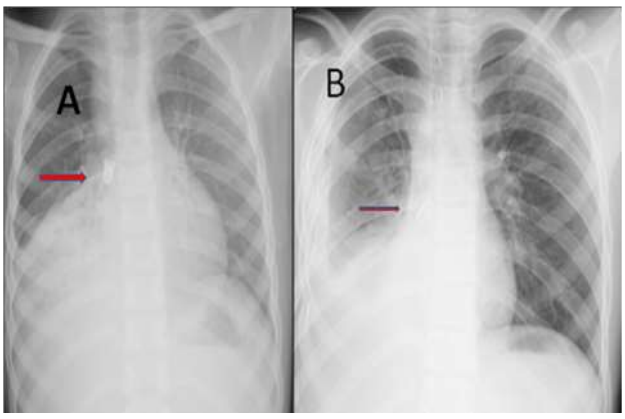

Figure 3 (A): Chest X-ray - Red colored arrow indicates metallic pen cap in the right bronchus. (B): Chest X ray -Red coloured arrow indicates Push board pin lodged in the right main bronchus.

In our study unilateral diminished breath sounds were the commonest sign and the commonest radiological feature was obstructive emphysema (Figure 1A, Table 4).

Table 6: Various types of FBs.

Types and variety	No of cases	% of cases
Vegetative	**216**	**91.1%**
Peanut	150	49.8
Coconut piece	07	2.32
Gram dal	5	1.66
Tamarind seed	04	1.32
Areca nut piece	10	3.3
Orange seed	1	0.33
Custard seed apple	4	1.32
Each of cotton seed cashew cut, almond and other seeds	1	0.33
Mutton piece	1	0.33
Each-Garlic, channa, corn	1	0.33
Non vegetative	**21**	**8.8%**
Whistle plastic	4	1.32
Plastic pen cap	6	1.99
Charcoal	1	0.33
Each-Nail, Push board nail, Screw, Metallic pen cap,	1	0.33
Metal foil	1	0.33
Each -Sewing needle, Ear stud, LED bulb	1	0.33
Each -Glass piece, Bone piece, Tooth	1	0.33

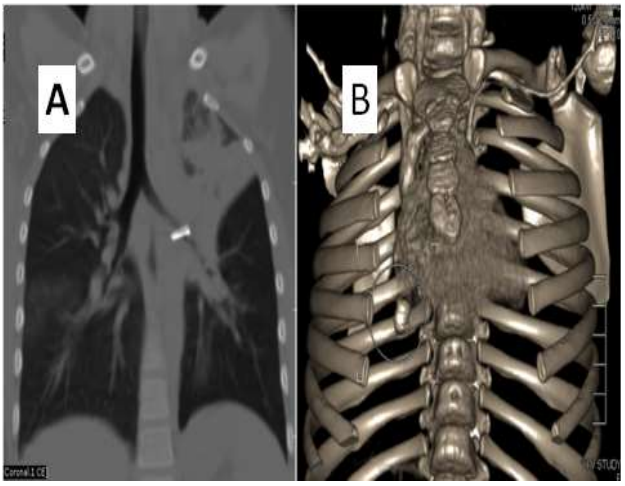

Figure 4 (A) : CT plain chest film-nail lodged across the left main bronchus. (B): Reconstructed CT Chest image showing metallic pen cap across the right bronchus.

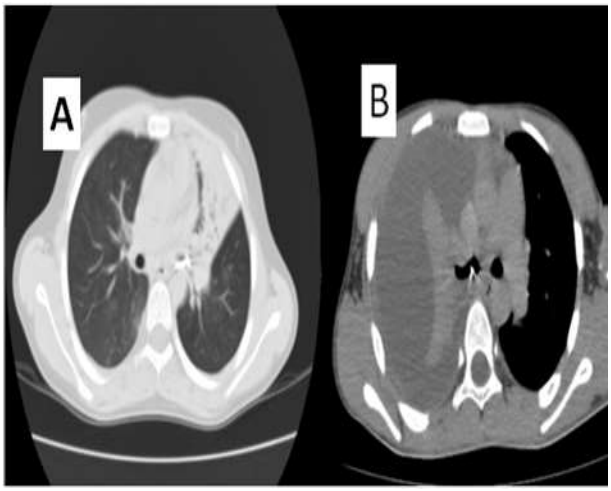

Figure 5 (A): CT chest showing metallic nail across the left main bronchus with underlying collapse consolidation of left lower lobe. (B) : CT Chest showing push board pin across the right bronchus with underlying consolidation.

The ventilating rigid bronchoscope remains the gold standard for the safe removal of tracheobronchial foreign bodies under general anaesthesia (Kozielski et al, 2000). The communication between the surgeon and anesthesiologist is most important. Selection of age appropriate equipment decreases post instrumentation edema. The treating surgeon /physician should be familiar and should have good experience with the wide variety of available foreign body extraction forceps. The optical forceps have markedly improved visualization, providing excellent illumination as well as magnification.[4] Patients underwent rigid bronchoscopy under general anesthesia combined with topical anesthesia. The second re look bronchoscopy was done to confirm no residual or fragments of FB in the tracheobronchial tree in cases of difficult FB extractions which required multiple attempts and which required the crushing of vegetative larger FBs especially in tamarind seed and custard apple seeds. Most of the children settled with nebulization and physiotherapy without requiring further relook bronchoscopy. Most of the children were discharged very next day of bronchoscopy. Those who required post procedural ventilator were very few, but even they were discharged in 3 days.

Table 7 : Surgical interventions.

Surgical interventions	No of cases	%
Tracheotomy +Laryngotomy	1	0.33
Bronchotomy	3	0.99
Thoracoscopy	1	0.33

There were three interesting cases in our series, one was a case of LED bulb aspiration was managed effectively by bronchoscopy (Figure 2A). Another was a sewing needle aspiration which has migrated into posterior mediastinum, has been managed conservatively so far and on close follow up (Figure 2B). One patient presented with metallic nail in the right main bronchus having respiratory distress, was found to have no FB on bronchoscopy, surprisingly had migrated to gastrointestinal tract and eventually passed in stools uneventfully (Figure 6 and 7).[21]

Figure 6 (A): A chest X ray showing right lung consolidation with no evidence of radio opaque FB. (B) :The FB, metallic foil retrieved by thoracoscopy.

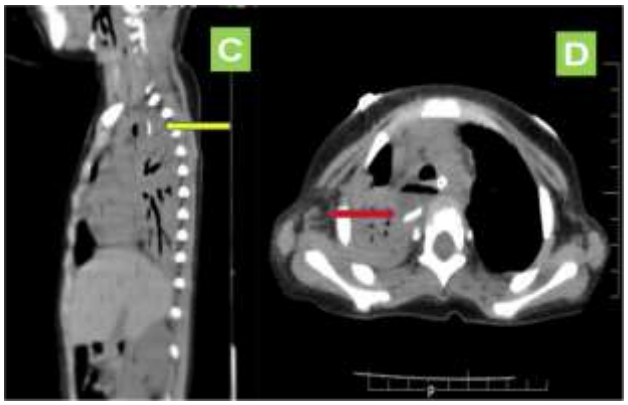

Figure 7(C) : CT scan thorax –sagittal section showing radio opaque FB posterior to cricopharynx.(D): CT scan thorax-transverse section - showing thin linear radio opaque FB.

Surgical intervention was required in 5 cases, who presented with chronic symptoms with recurrent chest infections. Among which 3 cases required bronchotomy and 1 case of glass pieces required tracheotomy and laryngotomy for retrieval. One case of metallic foil in cricopharynx was presented with respiratory distress, had the FB migrated to posterior mediastinum and hence required thoracoscopic retrieval (Figure 6B). We had two mortalities in our series, one baby presented with respiratory distress where urgent bronchoscopic retrieval of FB was done. But unfortunately baby had cardiac arrest during the procedure and could not be revived. Another was a child who had metallic foil in cricopharynx, presented with respiratory distress. Metallic foil was missed on serial chest X rays (Figure 6A) and bronchoscopy was also negative, further

delaying the diagnosis. Subsequent CECT revealed metallic foil migrating into posterior mediastinum from the cricopharynx, Thoracoscopic retrieval of metallic foil was done (Figure 7C and D), but unfortunately baby developed ARDS and shock.

Table 8: Foreign body status.

FB status	No of cases	% of cases
FB Positive	237	78.7
FB Negative	64	21.2
Total	301	100

CONCLUSION

Foreign body aspiration is a major health problem especially in children. It requires high degree of suspicion by attending physician and the surgeon, especially when history is not available. Rigid bronchoscopy is diagnostic as well as therapeutic even when routine chest x ray is normal. Surgical intervention may be required who present late with complications.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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