International Surgery Journal
Patil RT et al. Int Surg J. 2017 Jun;4(6):1889-1895
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: http://dx.doi.org/10.18203/2349-2902.isj20172128

Original Research Article

Foreign bodies in aero-digestive tract in children: spectrum of presentation and management

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Received: 18 April 2017
Accepted: 13 May 2017

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ABSTRACT

Background: Foreign body (FB) ingestion and aspiration is quite common in children. It can be a life-threatening condition. Early diagnosis of foreign body aspiration is essential as delay in its recognition and treatment results in high morbidity and mortality. Symptoms seem to mostly depend on the anatomical location. The absence of specific symptoms indicating the occurrence of FB injury can lead to delay in diagnosis, thereby increasing the risk of complications.
Methods: This is a prospective study which comprised of 50 patients with between 8 months and 4.5 years. FB involving different parts of the aero-digestive tract were included in the study. The site, side, symptoms and radiographic findings were recorded for each patient. Different procedures were used for retrieval of various FB at different locations. Majority of these procedures were performed under anaesthesia.
Results: Most of the FB were organic in nature. Right side bronchus was more commonly involved. A combination of different procedures was used according to the site involved. All the FB were removed successfully and smoothly. There was minimum morbidity with no mortality and the overall outcome was excellent. Hospital stay varied according to the site of involvement.
Conclusions: The symptoms of FB change with the site involved and many patients are even asymptomatic. A differential diagnosis of foreign body should always be made in an acute or chronic presentation of respiratory cases. Aspiration of foreign body should be suspected in all cases of broncho-pulmonary infection with atypical course. High index of suspicion is the cornerstone of diagnosis. Bronchoscopy is the best diagnostic and therapeutic method in all suspicions of foreign body of tracheo-bronchial tree. Proper and timely intervention optimizes the outcome.

Keywords: Bronchoscopy, Cricopharynx, Children, Foreign body aspiration, Respiratory distress, Upper GI endoscopy

INTRODUCTION

Foreign body (FB) ingestion and aspiration is quite common in children. It is a life-threatening condition. In any child presenting with sudden history of respiratory distress and associated decreased chest movement and air entry on the affected side, FB aspiration should be strongly suspected. Even the absence of signs and symptoms does not rule out FB especially when there is positive history of FB ingestion present. Early diagnosis of foreign body aspiration is essential as delay in its recognition and treatment results in multitude of complications.[1] Nevertheless, clinical presentation of aspiration can be subtle, mimicking other respiratory conditions, resulting in mismanagement.[2,3] High index of suspicion is the cornerstone of diagnosis. Emergency surgery is life saving and also decreases mortality and morbidity.

METHODS

This is a prospective study which was performed in few tertiary care hospitals from July 2014 to December 2016. The youngest patient operated was 8 months and the oldest was 4.5 years with a mean of 2.5 years. In our study total 50 patients were included of which 30 (60%) were males and 20 (40%) were females. In this study patients who had foreign body in any part of aero-digestive tract were included. Depending on the site of foreign body the patients were classified into nasal, cricopharygeal, esophageal, tracheo-bronchial and gastro-intestinal (GI) involvement (Figure 1).

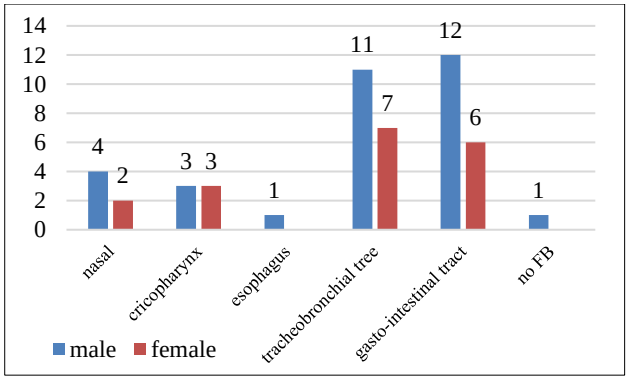

Figure 1: Sex-distribution of various foreign bodies at different sites.

Table 1: Distribution of patients according to site, side, symptoms, radiology and procedure performed for various FB.

Site	No. of patients	side	H/o FB ingestion	X-ray	Symptoms	Procedure
Nasal (06)	5	rt=5	5	Not done	Asymptomatic (5)	Removal by McGill forceps on OPD basis
	1	lt=1	None	Not done	foul smelling nasal discharge (1)	
Cricopharynx	6	-	5	Radio-opaque FB +	Asymptomatic (5) stridor, tachypnea, severe respiratory distress (1)	Direct laryngoscopy with removal by Mc Gill forceps
Esophagus	1	-	1	Open safety pin in mid esophagus	Asymptomatic	Esophagoscopy ± bronchoscopy
Tracheo-bronchial tree	18	Right bronchus=12 Left bronchus=6	12	Hyperlucent lung, few were collapsed, consolidation lung	Respiratory distress in majority of patients (15)	Bronchoscope with optical forceps
Gastro-intestinal tract (GIT)	18	-	18	Radio-opaque FB +	Asymptomatic (18)	Removal by upper GI endoscopy with basket (3 patients)

The site of FB, side involved, symptoms, radiological findings and procedure performed for different FB have been contrasted in Table 1. A wide spectrum of foreign bodies of different nature were retrieved from different sites in aero-digestive tract of which majority were vegetative in origin (Table 2).

These children presented with wide spectrum of symptoms according to the site of involvement along with history of FB ingestion or aspiration. A large number of patients also presented without any symptoms but with positive history of FB ingestion /inhalation. One child with tamarind seed in right nostril presented with complete nasal blockade and foul smelling discharge from that nostril. Another child with button battery ingestion presented with stridor, tachypnea and severe respiratory distress. On radiological examination, round shaped FB was seen at cricopharynx region. Chest radiograph was within normal limits and did not correlate with the clinical condition of the child. On laryngoscopy, this patient had an additional radiolucent FB, piece of balloon proximal to button battery was present which was the cause of stridor and respiratory distress.

The patients with involvement of tracheo-bronchial tree presented with history of FB aspiration along with respiratory complaints like persistent sudden cough, choking, wheezing, stridor and respiratory distress. In most of these cases air entry was either decreased or completely absent on the affected side. All children with GI foreign bodies were asymptomatic. One patient with sudden history of stridor and intercostals indrawing underwent bronchoscopy for suspected FB. But there was no FB.

Radiological imaging was used judiciously in all the patients to ascertain the presence and nature of FB. No radiological investigation was done in patients with nasal FB where it was visible externally. In all the patients who presented with FB in cricopharynx X-ray of neck and chest was performed. All of them had radio-opaque FB except the one with button battery ingestion who showed one radio-opaque FB and a more radiolucent one proximal to it (Figure 2 and 3) Esophageal FB I.e. open safety pin was also distinctly visible on X-ray (Figure 4). In patients who presented with tracheo-bronchial FB the X-ray findings in majority of patients were hyperlucent lung, in few patients collapsed and consolidation lung (Figure 5). In one patient X-ray was inconclusive hence CT scan of thorax was performed which confirmed the FB. X-rays done in all the patients with GI foreign bodies revealed radio-opaque FB in stomach.

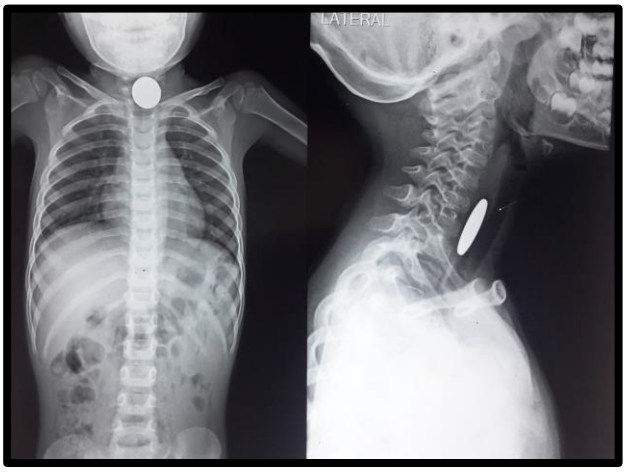

Figure 2: X-ray showing radio-opaque FB (coin) in cricopharynx.

Figure 3: X-ray showing radio-opaque toy part in cricopharynx.

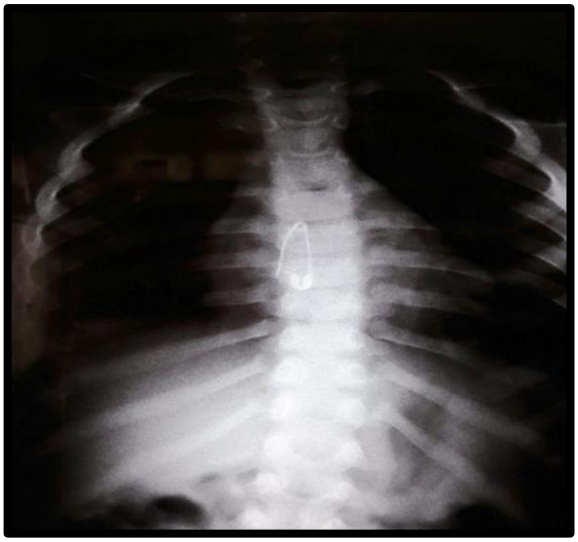

Figure 4: X-ray showing radio-opaque FB (open safety pin) in mid-esophagus.

Figure 5: X ray chest showing hyperlucent left lung which is indirect evidence of radiolucent FB in left bronchus.

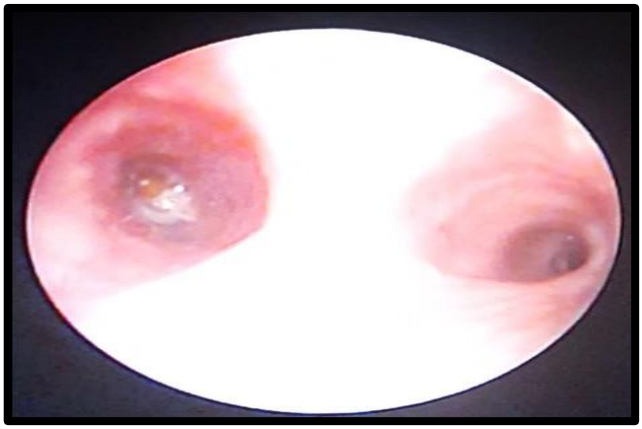

Figure 6: Bronchoscopic view -FB in left main bronchus.

FB retrieval was performed in all the patients successfully. Different procedures were performed according to the site of FB. In Patients with nasal FB small McGill forceps was used to retrieve FB under sedation on day care basis. In patients with FB in cricopharynx, direct laryngoscopy was done with long blade and subsequently McGills forceps was used to remove the FB. In all the patients with tracheo-bronchial FB, rigid bronchoscope with optical forceps was used to retrieve the FB. (Figure 6) In one baby FB was very tiny sitting in bronchiole and optical forceps could not be opened at that point, so procedure was abandoned and next day bronchoscopy was done using uretero-renoscope and FB was retrieved successfully. All the children who presented with FB in GI tract were initially managed conservatively on outpatient basis and asked to come for regular follow up. Caretakers were told to check the stools every time child passes. 15 patients passed FB in stools within 5-10 days. 3 babies had retention FB (coin) in stomach for more than 2 weeks. These patients were subjected to upper GI endoscopy under general anaesthesia and FB coin was removed using basket.

Table 2: Distribution of patients according to site and nature of FB.

Serial No.	Site and nature of foreign body	No. of patients
A	**Nasal Foreign body (6 patients)**	
1	Nuts	2
2	Tamarind seeds	2
3	Pomegranate seed	1
4	Thermocol piece	1
B	**Cricopharynx (6 patients)**	
1	Coins	4
2	Toy part	1
3	Button battery	1
C	**Esophagus (1 patient)**	
	Open safety pin	1
D	**Tracheo-bronchial tree (18 patients)**	
1	Ground nut piece	9
2	Betel nut piece	5
3	Bengal gram	2
4	Almond piece	1
5	Coconut shell piece	1
E	**Gastro-intestinal tract (18 patients)**	
1	Coins	11
2	Nut Bolts	4
3	Closed safety pen	2
4	Toy- spring	1

RESULTS

In all the 50 patients FB removal was performed smoothly and successfully. In all the patients with tracheo-bronchial FB, X-ray chest was done post-operatively to confirm the retrieval and assess the condition of the underlying lung. Post-operative X-ray showed significant improvement in terms of hyperlucency, mediastenal shift and collapse consolidation. Postoperative chest physiotherapy was given to all children with tracheo-bronchial FB. Post-operatively one baby had pneumo-mediastenum and pneumothorax. Intercostal drain was put and baby was put on ventilator for one day and the child recovered completely. No mortality was observed. All FB were removed on the day of admission. All nasal FB except one case were removed on outpatient basis. Cricopharyngeal and Esophageal FB were removed under general anaesthesia (GA) and discharged within 24 hours. Tracheo-bronchial FB were removed under GA using rigid bronchoscope with optical forceps on the day of admission. Average hospital stay was 3.5 days in these patients. Majority of patients with FB in GI tract were treated on outpatient basis. Only Three patients required upper GI endoscopy under GA and were discharged within 24 hours.

DISCUSSION

The human body has numerous defense mechanisms to keep the airway free and clear of extraneous matter. These include the physical actions of the epiglottis and arytenoid cartilages in blocking the airway, the intense spasm of the true and false vocal cords, and a highly sensitive cough reflex with afferent impulses generated throughout the larynx, trachea, and all branch points in the proximal tracheo-bronchial tree. However, none of these mechanisms is perfect, and foreign bodies frequently lodge in the airways of children. Children are more prone to aspirate foreign material for several reasons. The lack of molar teeth in children decreases their ability to sufficiently chew food, leaving larger chunks to swallow. The propensity of children to talk, laugh, and run while chewing also increases the chance that a sudden or large inspiration may occur with food in the mouth. Children often examine even nonfood substances with their mouth.

The male to female ratio of 1.5:1 as reported from our series is similar with that reported by other studies.4-6 The reason for male predominance remains unclear, however, some attributed it to the more adventurous and impulsive nature of young boys.[7]

The most common entities aspirated are small food items such as nuts, raisins, sunflower seeds, betel nut and nonfood items like tamarind seed, coins, button batteries etc. Dried foods may cause progressive obstruction as they absorb water. Button battery FB are very dangerous as the mechanism of injury is related primarily to the generation of hydroxide radicals in the mucosa, resulting in a caustic injury from high pH. Various studies have documented that necrosis can spread from lamina propria to outer muscular layer within 30 minutes and the chances of injury are three times higher with newer batteries.[8,9] The high degree of morbidity and mortality that has been observed with button battery ingestion in

children. Types of injuries sustained have included tracheoesophageal fistula (47.9%), esophageal perforation (23.3%), esophageal strictures (38.4%), vocal cord paralysis from recurrent laryngeal nerve injury (9.6%), mediastinitis, cardiac arrest, pneumothorax, and aortoenteric fistula.[9]

Even though cricopharyngeal and oesophageal foreign bodies are potentially hazardous and may pose problems regarding their diagnosis and management, they appear less dangerous than those in the respiratory passages.[10,11] Failure to treat them timely can result in complications such as retro-pharyngeal or retro-oesophageal perforation, ulcerative oesophagitis, oesophago-respiratory fistula, recurrent pneumonitis, stricture formation and impaction. Oesophagoscopy, cricopharyngoscopy and direct laryngoscopy can be used to remove these FB. Most of the FBs are arrested at a distance of an inch below the cricopharyngeal sphincter which has been attributed to the phenomenon that the strong propulsive pharyngeal muscles force an object this far while the less active oesophageal musculature cannot carry it further. The mobile redundant mucosa of this region, perhaps, adds to the hazard.[12]

A history of choking is reported to have a high clinical sensitivity (97%) as well as clinical specificity (63%) in the diagnosis of foreign body aspiration.[13] The classic triad of wheeze, cough, and diminished breath sounds, despite its high specificity of 96% - 98% is not present universally.[14,15]

Decreased air entry accounts for the predominant physical finding in our study, followed by tachypnea This finding has high specificity but is subjective and does not give much clue to the position of the foreign body.[3,16] Normal chest radiograph should not rule out the possibility of FB aspiration, though a positive finding may be highly suggestive of its presence.[17-19] This low sensitivity could be secondary to the fact that many foreign objects consumed by children are radiolucent in nature.

Most common FB implicated are organic in nature, of which, peanuts predominates. Peanut is similarly the chief culprit in other studies.[20] The foreign body implicated is to a certain extent dependent on the education, culture and dietary habits of the country. Hence, parents should be educated on food safety and keeping food such as peanut out of reach from their young children.

Anatomically, the greater diameter, smaller angle of divergence from the tracheal axis and greater airflow, favours the entry of foreign body in the right bronchus. The incidence of foreign body in the right bronchus in our series is 12 (66%) as compared to 6 (33%) in the left bronchus. Higher incidence in right bronchus is similarly reported in most studies.[20,21] Even in nasal FB right side was predominantly involved in this study.

Rigid bronchoscopy is the standard of care in the management of cases of suspected FB aspiration. It is the procedure of choice to identify and remove the object due to its better control of the airway, allowing good visualization and manipulation.[22,25-27] In our institution, all cases of foreign body aspiration were extracted using rigid bronchoscopy. Flexible bronchoscopy is also advocated by some author sand complication rate reported to be as low as 0.3% versus 1.1% from rigid bronchoscopy.[28] Early bronchoscopy is essential since the complication rate was found to be twofold higher in patients who underwent bronchoscopy after 24 hours. If the FB is lost during retrieval, usually in the narrow subglottis space, the object should be pushed down into a main stem bronchus to allow sufficient ventilation and oxygenation before reattempting retrieval. The advantages of rigid bronchoscopy include the ability to function as an endotracheal tube, securing the airway and providing a conduit through which the foreign body can be removed, and the variety of instruments that can be used to retrieve foreign bodies. The anaesthetic management of FB aspiration is crucial and challenging. Time should be taken to complete other preparations for bronchoscopy, unless the obstruction is critical and the airway is compromised. Adequate fasting pre-operatively should be given due emphasis.

The overall complication rate and hospital stay in our study was in accordance with previous studies. There was no mortality in our series as has been described by some other authors with larger series of patients.[29-31] Bronchoscopy was done in all patients within 24 hours from admission. Excellent post-operative recovery again emphasized the safety and favorable outcome of timely and properly performed bronchoscopy.[25,26,32]

Gastric coins can generally be managed expectantly, unless overt GI symptoms are noted. In asymptomatic patients, parents should be instructed to monitor the stools for passage of the coin and serial X-rays obtained every 1 to 2 weeks until clearance can be documented. If the coin is retained after 2 to 4 weeks of observation, elective endoscopic removal may be considered. Although no studies specify a specific time limit by which most spontaneously passed coins will exit the stomach, children with underlying anatomic or surgical changes, such as pyloromyotomy, may have increased risk for retained coins.[33,34]

CONCLUSION

Accidental inhalation of both organic and non-organic FBs continues to be a cause of childhood morbidity and mortality. Prevention is best, but early recognition remains a critical factor in the treatment of FB inhalation in children. Patients should be sent to experienced centres for evaluation and treatment. Coughing, choking, acute dyspnoea, and sudden onset of wheezing are the most common symptoms. A history of FB ingestion/inhalation is usually positive. Any unexplained persistent cough

with refractory parenchymal infiltrates should raise suspicion of unrecognized FB. Undiagnosed and retained FBs may result in asphyxia, pneumonia, atelectasis, and bronchiectasis. Early intervention in the form of bronchoscopy is life saving and decreases mortality and morbidity. Gastric FB can be managed conservatively if asymptomatic, but needs removal if it retains more than expected interval in stomach.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the institutional ethics committee

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Cite this article as: Patil RT, Prakash A. Foreign bodies in aero-digestive tract in children: spectrum of presentation and management. Int Surg J 2017;4:1889-95.