

MANAGEMENT OF FOREIGN BODY INHALATION IN CHILDREN: EXPERIENCE FROM A PEDIATRIC SURGERY CENTER**Marwa Salim Al_Dabbagh^{*1}, Muataz Abduljawad Al-ani²**¹M.B.Ch.B. - F.I.B.M.S, Specialist Pediatric Surgeon/ Department of Pediatric Surgery Mosul –Iraq.²M.B.Ch.B - F.I.B.M.S - E.B.P.S, Consultant Pediatric Surgeon/ Department of Pediatric Surgery Mosul –Iraq.

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INTRODUCTION

Accidental inhalation of foreign bodies remains a significant cause of morbidity and mortality in children, necessitating prompt recognition and timely intervention to reduce the risk of fatal outcomes.^[1] Young children are particularly vulnerable due to their natural tendency to place objects in their mouths, making foreign body aspiration one of the most common causes of accidental death in those under six years of age.^[2, 3] In Iraq, the prevalence of tracheobronchial foreign body aspiration is notably high, often linked to inadequate parental supervision and neglect of dietary safety practices.^[4] A lack of awareness and insufficient knowledge among caregivers contributes substantially to these accidents. Consequently, foreign body aspiration represents a pressing public health concern, requiring both preventive strategies and effective clinical management.^[5] The primary objective of this study is to evaluate the clinical management of foreign body inhalation in a pediatric surgery center. The only facility in the region equipped to handle pediatric emergency surgical conditions, given the absence of an otolaryngology department within the hospital or nearby centers. Particular emphasis will be placed on the role of a documented history of choking as a diagnostic and prognostic factor in the assessment and treatment process.

PATIENTS AND METHOD

A prospective case series study was conducted over 12 months in the Pediatric Surgery Center at Alkhansaa Teaching Hospital, Mosul, Iraq, commencing on January 1, 2020. All patients aged less than 14 years presenting with suspected foreign body (FB) inhalation were included. Data collection encompassed demographic variables (age, sex, and residency), clinical history with particular attention to penetration syndrome (history of choking), clinical signs and symptoms, radiological findings (chest X-ray), and bronchoscopic findings. The inclusion criteria include children with a history of choking, any child with Chest X-ray abnormalities, and recurrent chest infection not respond to treatment. Rigid bronchoscopy was done under general anesthesia. Rigid bronchoscopes (Karl Storz 2.5 mm, 3 mm, 3.5 mm, 3.7 mm, 4 mm, 5 mm, and 6 mm) were used. Management outcomes were systematically recorded. Statistical

analysis was performed using the Statistical Package for the Social Sciences (SPSS), version 25.

We used Statistical Package for the Social Sciences version 25 for Statistical analysis and presentation of data.

RESULTS

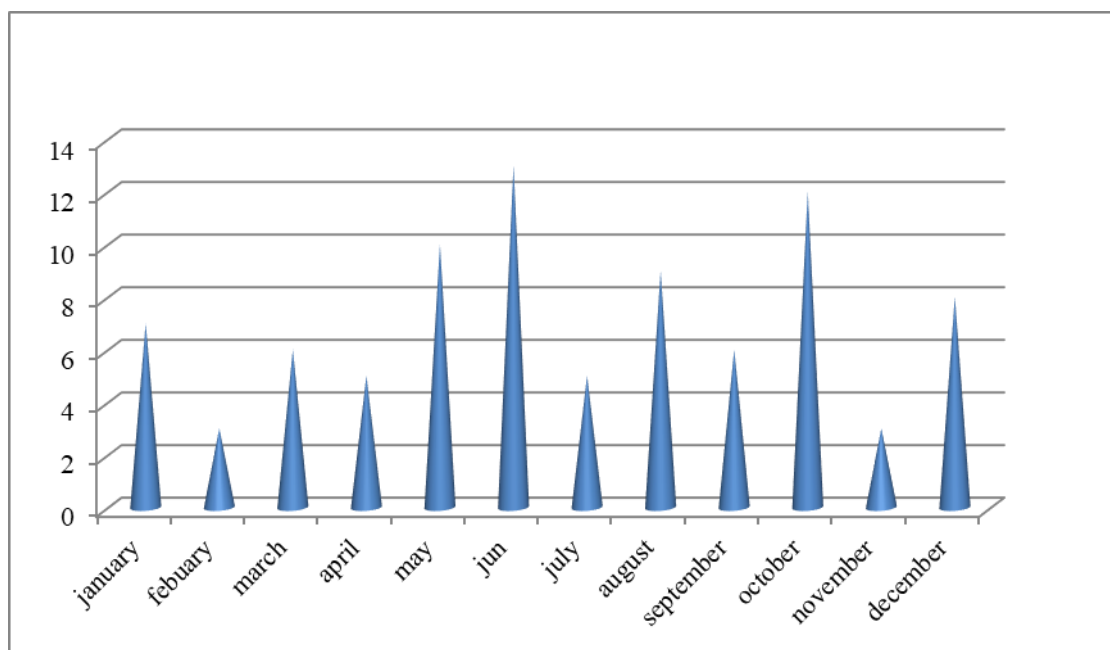
Over a one-year study period, (87) children were admitted with a diagnosis of suspected FB inhalation. Of the 87 children, 44 were male (51%), and 43 were female (49%), giving a male-to-female ratio of approximately 1: 1. one half of our children (55%) presented within the first 24 hours from inhalation. The mean age of the children who inhaled a FB was 2.9 years (range from 7 months to 12 years; medium 2 year).

The most common age was between 1-2 years. (table1).

Table 1: Age of presentations for children with FB inhalation.

Age group (years)	Male	Female	Total
<1	7	6	13
1-2	14	16	30
2-3	9	10	19
3-4	3	2	5
4-6	3	3	6
>6	8	6	14
Total	44	43	87

About one-third of all studied groups were presented during summer season and especially during June as shown in figure 1.

**Figure 1: Frequency of presentation of suspected foreign body inhalation all over one year.**

During the study period, we found that the history of choking for those suspected of having foreign body

inhalation is more common in rural areas, as shown in Table 2.

Table 2: Differences in foreign body inhalation according to place of residence, in relation to a history of choking and bronchoscopy findings.

Residence	Suspected Foreign body inhalation		History of Choking	Bronchoscopy finding	
	Number	Percent		Positive	Negative
Urban	36	(41%)	30 presents	26	4
			6 not present	1	5
Rural	51	(59%)	44 presents	33	11
			7 not present	5	2
Total	87	(100%)	74 presents	65	22
			13 not present		

The most common symptoms observed in patients with confirmed FB inhalation were choking (91%), followed by sudden cough (69%).
As shown in Table 3.

Table 3: Clinical signs and symptoms between positive and negative FB inhalation, sensitivity, specificity, and P value.

Clinical Signs And Symptoms (No=87)	FB Inhalation Positive No=65	FB Inhalation Negative No=22	Sensitivity	Specificity	P* value
Witnessed choking	59(91%)	15(68%)	79%	32%	0.010
Sudden Cough	45(69%)	14(64%)	69%	35%	0.627
Dyspnea	36(55%)	17(77%)	55%	23%	0.069
persistent cough	17(26%)	3(14%)	26%	86%	0.228
Fever	14(21.5%)	6(27.3%)	22%	73%	0.581
Cyanosis	3(4.6%)	2(9%)	5%	90%	0.597**
Stridor	9 (13%)	0 (0.0%)	14%	100%	0.104**
Rhonchi	35(54%)	10(45%)	54%	55%	0.496
Crepitation	12(18%)	8(36%)	18%	64%	0.085
Diminished air entry	26(40%)	1(4.5%)	40%	95%	0.002
Respiratory distress	3(4.6%)	2(9%)	5%	90%	0.597**
Recurrent chest infection	3(4.6%)	0 (0.0%)	5%	100%	0.568**
Normal auscultation	13(20%)	10(45%)	20%	55%	0.019
Others***	6(9%)	7(31%)	9%	68%	0.017**

* Chi square test ** Fisher exact test *** vomiting, dysphagia, drooling, drowsy.

According to the history of choking, we divided the presenting children into two groups.

Group 1: Seventy-four children had a positive history of choking; fifty-nine of them only show positive bronchoscopic finding of FB.

Group 2: Thirteen children with a negative history of choking, six of them had a positive bronchoscopic finding of FB.

The relation between the history of choking and bronchoscope findings is shown in table 4.

Table 4: The relation between history of choking and bronchoscope findings.

History of choking	Patients No	%	Bronchoscopy finding	Patients No.	%
Group 1	74	85.1	Positive	59	68
			Negative	15	17
Group 2	13	14.9	Positive	6	7
			Negative	7	8
Total	87	100	Positive	65	75
			Negative	22	25

Rigid bronchoscopy done for all children. In general there were no difficulties encountered during FB removal except the recording of transient severe hypoxemia associated with bradycardia in two patients with positive FB (walnut peel, bean) at the trachea and right bronchus level, respectively. Another complication occurred in another patient when he developed surgical emphysema after removing a FB (needle), and a tragic event happened when the grasper broke during the removal of an unusual FB (cap of a pen).

The most common foreign bodies were organic materials, as shown in Table 5.

Table 5: Types of encountered FB with their percent of distribution.

Type Of Foreign Body	No	%
Organic (Vegetable)		
Sunflower seeds	22	33.8
Peanut	14	21.5
Watermelon	2	3
Egyptian seed	3	4.6
piece of food	3	4.6
bean	1	1.5
piece of carrot	1	1.5
walnut peel	1	1.5
grape peel	1	1.5
orange seed	1	1.5
olive seed	1	1.5
Total Organic (vegetable)	50	76.5
Non -Organic (Non-vegetable)		
Needle	6	9
Cap of pen	2	3
Bead	1	1.5
Screw	1	1.5
diode light	1	1.5

stone	2	3
metallic piece	1	1.5
piece of material	1	1.5
total Non-Organic (Non-vegetable)	15	22.5
Total	65	100

The right main bronchus was the commonest site for FB impaction, which was seen in 39 patients (60%), as shown in Table 7.

Table 6: Site for FB impaction with its percent of distribution.

Site of FB	No	%
Rt. Bronchus	39	60
Lt. bronchus	18	27.6
Rt. and lt. bronchus	1	1.5
Trachea	7	10.7
Total	65	100

Rigid bronchoscopy was done as an emergency operation in about two-thirds of patients (70%), as shown in Table 7.

Table 7: Time of bronchoscopy with relation to bronchoscopy findings.

Time of bronchoscopy	Patients no.	Bronchoscopy finding	
		Positive	Negative
Emergency	60	45	15
Elective	27	20	7
Total	87	65	22

DISCUSSION

FB inhalation is still not uncommon in our locality. It needs a high index of suspicion for early identification and intervention. It should be in the mind of an emergency doctor (or emergency doctors) whenever a child between 1-3 years presents with an attack of choking, especially with diminished air entry, and rigid bronchoscopy is a lifesaving procedure for removing FB inhalation. Alkhansaa teaching hospital pediatric surgery center is the only hospital dealing with pediatric emergency surgical conditions, and there was no ENT department either in this hospital nor in nearby centers, which is our main concern.

In our study, FB inhalation affected male children in (51%) and was nearly equally affected as female children (49%), with a male to female ratio of approximately 1: 1 the same recorded as in Nasir and Alfaqe studies.^[6, 7] while male gender predominance is significant in Montserrat et al and Rashi et al.^[8, 9] This may be due to the more adventurous nature of male.^[7]

FB inhalation can occur at any age but the highest incidence of FB inhalation noted at age group of 1-3 years, This finding correspond to Naragund et al^[10], the increase incidence of FB inhalation in this young age group may be due to tendency to put objects in their mouth

causing inhalation of these objects into tracheobronchial tree while playing or talking especially if its associated with laughing or crying.^[11]

In our study, we found that the highest seasonal peak of FB Inhalation was in summer, as reported in Hussain's study.^[12] This may be due to over activity of children in these months.

During our study period, and in comparison between a rural and an urban area, we found that FB inhalation was more common in the rural area. This finding may be attributed to the high number of children in rural area leading to a lack of proper familial follow-up of little baby. We also found the history of choking is more accurate in urban areas, which may be due to close follow-up of parents, so we touch the fact that the history of choking is unreliable in rural areas and it's important to look for other signs to support the decision of bronchoscopy as diminished air entry which had 95% specificity for FB inhalation in our study.

The early diagnosis and early presentation of a child with FB inhalation is fundamental for proper intervention and certainly associated with decrease the morbidity of the condition, we found that about half of children (55%) with FB inhalation presented in the first 24 hour as in Ahmed study (43%)^[13], indicates a high suspicion index by caretakers due to the presence of choking make them fear and seeking consultation. There was a late presentation up to four months, which may be due to recovery after cough (symptom-free interval), and the first examining doctor did not put FB inhalation as a differential diagnostic consideration.

In our study the patients usually presented with a combination of signs and symptoms, choking was recorded in (68%) make it highly significant symptom in children had FB inhalation (p value 0.010.) which differs from others like Fasseeh et al and Sahdan et al (54% 33%) respectively^[14, 15], but despite of that we found that we cannot depend on choking alone for accurate diagnosis of FB, Table 3.

The clinical examination was similar across all age groups. The most common examination findings were rhonchi followed by diminished air entry in the affected side (54%, 40%), respectively, as in Alfaqe's study.^[7] while Fraga et al and Cohen et al shows that the most common examination findings were diminished air entry in the affected side, followed by rhonchi.^[16, 17] Stridor and diminished air entry had a high specificity sign for FB inhalation (100%, 95%), respectively, p value of diminished air entry with no added sound (0.002, 0.019), respectively were significant.

In our study, about 20% of Chest X-ray show radiopaque FB correspond to the Cataneo study.^[18] Accordingly, a chest X-ray cannot reliably exclude foreign body inhalation; rather, it may reveal indicative signs in

approximately 72% of cases.^[19] Findings included local hyperinflation, unilateral atelectasis, or obstructive emphysema. Usually, inspiratory-expiratory film in anterior-posterior view is likely to reveal the overinflation as a hyperlucency best during expiration.^[20] So, even with normal clinical findings and normal radiograph findings, FB inhalation cannot be excluded.

We faced one parent who refused bronchoscopy intervention, and they treated their baby as a recurrent chest infection. After four months baby developed Cushing facies, a CT scan of the chest was done, there was lobar pneumonia with negative FB, surprisingly, bronchoscopy was positive, and (sunflower shell seed) was removed successfully without any complications.

In Iraq, the most common organic FB is sunflower seed^[21], as in our study. organic FB is more common than inorganic (78% versus 22.5%) as in Parameswaran^[22] but organic FB were nearly equal to inorganic FB in age more than 6 years old this may be due to that parents less afraid if they see their babies catch this inorganic materials. In our study the most common inorganic FB was needle /pin.

In our study, the most common site of FB lodgment was in the right bronchus for all age groups, as seen in Kaur et al and Ramirez-Figueroa et al.^[23, 24] This belongs to the anatomy of the right bronchus, which is shorter, wider, and more vertical.^[13] We had one case with bilateral bronchial FB inhalation (sunflower seeds) in a patient aged one and a half years; a similar case is reported by Alfaqe study.^[7]

During the bronchoscopy procedure, two patients developed bradycardia and transient severe hypoxemia with induction of anesthesia because of some difficulty in insertion of the bronchoscope, and another patient developed surgical emphysema after removing a foreign body (needle), which resolved spontaneously. An unusual intraoperative complication was encountered in one patient when the grasper fractured during the removal of a foreign body (a pen cap). This incident highlighted the necessity of ensuring the availability of multiple graspers in the operating theater to manage such unforeseen events. Complete removal of FB is achieved in all cases except for patient had multiple fragments of FB; the majority of fragments were extracted by grasper and suction with irrigation.

Tracheostomy or thoracotomy was not recorded during our study period. No postoperative complications were observed following bronchoscopy. All patients were discharged within a maximum hospital stay of 24 hours, and no mortality was reported in our study, consistent with the findings of Alfaqe.^[7] This favorable outcome may be attributed to the presence of a well-trained multidisciplinary team, including anesthetists and pediatric surgeons, experienced in managing foreign body inhalation cases at our center.

CONCLUSIONS

This study highlights the efficiency of the pediatric surgery team in managing foreign body inhalation among children. A positive history of penetration syndrome (choking) was identified as a strong clinical indicator of aspiration. Rigid bronchoscopy proved to be a safe and effective diagnostic and therapeutic tool, with no reported complications and short hospital stays.

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