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Foreign body aspiration in children: Experience from 2624 patients

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ABSTRACT

Objectives: The objective of this study is to analyze the epidemiological, clinical, radiological and endoscopic characteristics of pediatric foreign body aspiration in Algeria.
Methods: In this retrospective study, the results of 2624 children younger than 18 years admitted in our department for respiratory foreign body removal between 1989 and 2012, were presented. Most of them had an ambulatory rigid bronchoscopy.
Results: The children (62.34% males and 37.65% females) were aged 4 months to 18 years with 66% between 1 and 3 years. Choking was related in 65% of cases. The delay between aspiration and removal was 2–8 days in 65.8% and within 24 h in 9.2%. In the most cases, the children arrived with cough, laryngeal or bronchial signs and unilateral reduction of vesicular murmur. The examination was normal in 13%. The most common radiologic finding was pulmonary air trapping (40.7%). The aspirated bodies were organic in 66.7%, dominated by peanuts, while sunflower seeds, beans and ears of wheat were the most dangerous. In the other cases, they were metallic or plastic as pen caps and recently scarf pins. The endoscopic removal by rigid bronchoscopy was successful and complete in 97%. Cases with extraction failure (3%) limited to certain FBs, all of them inorganic were assigned to surgery. The complications related to the endoscopic procedure were 0.29% with a mortality of 0.26%.
Conclusion: Foreign body aspiration is a real public health problem in Algeria. The best way to manage it is an early diagnosis and a rigid bronchoscopy removal under general anesthesia used by fully trained staff. The prevention of this domestic accident should consider the population lifestyle and cultural habits to be more effective.

1. Introduction

Foreign body (FB) aspiration remains a public health problem in many countries, attested by the recent publications [1–4]. Cultural and religious habits, often inaccessible for standard prevention, are reasons of the high frequency of this issue, especially in Middle East and Maghreb countries [3–5]. Thankfully, miniature equipment and advances in anesthesia and in removal procedure achieved by experienced teams, improved the outcome of this accident.

Interventional bronchoscopy is usually accomplished by surgeons or ENT. In our university public hospital which is financed by the ministry of health and social security funds and accessible for all patients, the pediatric bronchoscopy unit, composed exclusively of pediatricians, assisted for this purpose by intensive care physicians manages the most cases of pediatric FB aspiration occurring in our country for over 25 years.

2. Methods

We retrospectively studied all the children younger than 18 years directed to our unit for respiratory FB removal, between 1989 and 2012. We report our experience of 24 years with more than 6000 bronchoscopic procedures for FB aspiration in children. We analyzed only cases confirmed with removal of the FB (negative endoscopic procedures for suspected FB aspiration were excluded). All these patients had a clinical report made by the family physician and one or more chest radiographs. No other imaging technique (CT, IRM, etc.) is required in our practice. Until 1994, all the patients had rigid bronchoscopy (Karl Storz) under local anesthesia (Lidocaïne 1%) and premedication (Midazolam – Atropine). This process was replaced by general anesthesia (Propofol – Fluothane) since 1995. The FB was removed immediately or some hours after the patient arrival, without hospitalization unless complications. The removal was delayed if

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Table 1
Number of endoscopic procedures performed for foreign body aspiration.

Bronchoscopy	Number	%
All reasons	14,558	100
FB aspiration	6298	43.26
FB removal procedures (even repeated)	2860	19.64
Flexible bronchoscopy for control	2907	19.92
Negative flexible bronchoscopy for FB suspicion	531	3.64

there was an infection or an obstructive bronchial granuloma. In these cases, the removal was performed after 8–10 days of treatment with antibiotics and steroids.

We analyzed:

- The relative importance of endoscopic procedures related to FBs in our unit,
- Age and sex ratio,
- Expression way of the accident,
- Time between the aspiration and the removal,
- Clinical and radiological signs at patient arrival,
- Endoscopic findings: FB nature, location, bronchial inflammation,
- Complications related to the FB or the endoscopic procedure,
- Immediate and short-term follow up after removal.

These eight sections were obtained from the standardized medical report completed for each patient, that enabled us to establish a database with Microsoft excel for a more practical treatment of the selected parameters. Endoscopic pictures were stored on software AÏDA system (Storz).

3. Results

Within the study period, 14,558 endoscopic procedures were performed, in which 43.26% were related to FB aspiration (Table 1).

Patients came from all parts of the country, often from remote southern areas. There is a steady increase in the recruitment (Fig. 1).

The patients were aged 4 months to 18 years with 2/3 of them between 1 and 3 years (Fig. 2).

The expression mode of the accident was choking in 65% with coughing and suffocation with or without cyanosis, often when the child was eating or playing. The delay between the accident and the removal was rarely less than 24 h (9.2%), 24–48 h (11.8%), 2–8 days (65.8%) and more than 8 days in 13.2%.

Males were more concerned with a sex ratio of 1.65.

On arrival, patients had cough with laryngeal or bronchial signs. Some of them were asymptomatic (Table 2).

The radiological findings are presented in (Table 3).

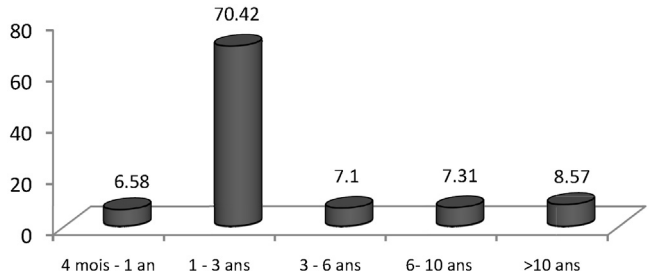

Fig. 2. Age of patients.

Right bronchial tree was involved in almost half of FB. For some patients, we were not able to locate the FB because of its mobility. In some other cases, we found endoscopic lesions testifying that FB stayed at that place and was thrown out by coughing (Table 4).

A wide range of FBs was found (Table 5) (Fig. 3). 66.7% were organic and the peanuts represented more than a half. Inorganic FBs were various; plastic objects with many pen caps (Fig. 4) and metallic objects (Fig. 5) with increasingly scarf pins (Fig. 6).

Inflammatory bronchial mucosa was always encountered. It was severe and hemorrhagic when the FB was organic especially beans and sunflower seed. Obstructive granuloma was found when FB stayed more than 8 days (Fig. 7). In these cases, the FB can be hidden and the removal can be difficult.

We noted complications related to the FB nature. One child died because of severe hemoptysis that occurred before removal of a sunflower seed aspirated many days earlier. Three other complications occurred with ear of Wheat aspiration; one transcutaneous chest expulsion of the FB (Fig. 8), one intra-pericardial migration of the FB which required pericardiotomy and the third one had a trans-diaphragmatic migration of the FB revealed by peritonitis which required surgery.

Endoscopic removal of FBs was successful in 97% and complete from the first attempt in 86%. Rarely (11%), it took until 3 attempts to remove all the residual fragments. Flexible bronchoscopy was performed for all patients 2–3 weeks after FB removal and revealed decline of the inflammation in most cases.

Table 2
Clinical signs on arrival.

Clinical signs	Number	%
Cough	1836	70
Respiratory distress	1653	63
Wheezing	1574	60
Reduction of vesicular murmur	1810	69
Laryngeal signs	183	7
No signs	341	13

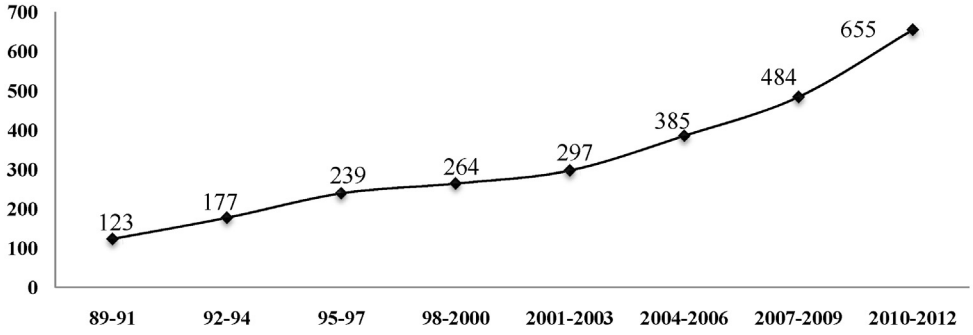

Fig. 1. Evolution of recruitment.

Table 3
Radiological findings.

Radiological findings	Number	%
Normal	310	11.83
Obstructive emphysema	899	34.26
Atelectasis	534	20.35
Pneumonia	249	9.48
Bilateral distension	169	6.44
Subcutaneous emphysema	11	0.41
Radiopaque FB	420	16.02
Pleural effusion	67	2.57
Destroyed lung (bronchiectasis, lung abscess, etc.)	15	0.60

Table 4
Foreign body location.

FB location	Number	%
Subglottic/trachea	369	14.01
Right bronchial tree	1275	48.44
Left bronchial tree	761	28.91
Bilateral	42	1.89
Undefined	185	7.71

Table 5
Foreign body nature.

Nature	Number	%
Organic FB	1751	66.7
Peanuts	1119	
Sunflower seed	144	
Almonds	60	
Ears of wheat	36	
Acorns	34	
Beans	31	
Bones	31	
Pistachio	27	
Others	269	
Inorganic FB	676	25.7
Metal	272	
Scarf pins	169	
Pins, nails, screws	50	
Others	53	
Plastic	230	
Pen caps	136	
Pearls	31	
Others	63	
Miscellaneous: stones, small light bulb, etc.	174	
Undefined	197	7.5

Fig. 3. Foreign bodies picture.

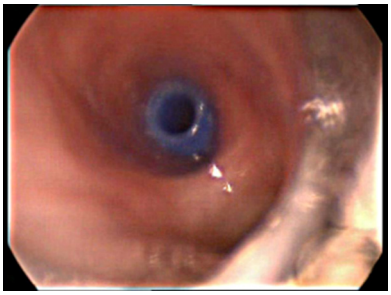

Fig. 4. Pen cap.

Fig. 5. Tack.

Bronchoscopy allowed us to remove all organic FBs. Failure of removal concerned metallic and plastic objects in 69 children (3%). These patients were directed to thoracic surgeons (Fig. 9).

Complications related to the endoscopic procedure are summarized in (Table 6).

4. Discussion

Foreign body aspiration is a leading domestic accident in children. It occurs typically when the child is eating or playing and expresses by a sudden respiratory distress.

The endoscopic removal of respiratory FB is not available in several regions in Algeria, so a lot of parents must travel many kilometers to reach this procedure. This explains the size of our recruitment and the increasing number of children directed to our specialized unit. In our study, 43.26% of endoscopic procedures were performed for FB aspiration (this percentage includes the removal procedures, the flexible endoscopies performed for control and negative endoscopies for suspected FB aspirations). This number indicates the importance of this pathology in our pediatric endoscopic activity. The rate of 19.64% dedicated expressly for FB removal approximates that reported in some countries with better health arrangement [6].

For over 20 years, the number of respiratory FB cases is increasing regularly. 100–150 cases per year are admitted in our unit. The reasons are the same reported in Egypt by Albirmawy and Elsheikh [3]; we had a tertiary care unit with a growing semirural population not prone to prevention and emergence of scarf pin aspiration in teenagers also encountered in other Maghreb countries [5,7].

The selection of the endoscopic material for the FB removal depends on the endoscopist preference. Some teams use flexible bronchoscopy with removal of substantially all FBs [8], while most authors consider rigid bronchoscopy the best procedure. In our practice, rigid bronchoscopy was performed after premedication and local anesthesia according to a French protocol [9]. Since 1995, the use of general anesthesia (Propofol i.v and inhaled fluothane) by our anesthetists made a great contribution. Although there is

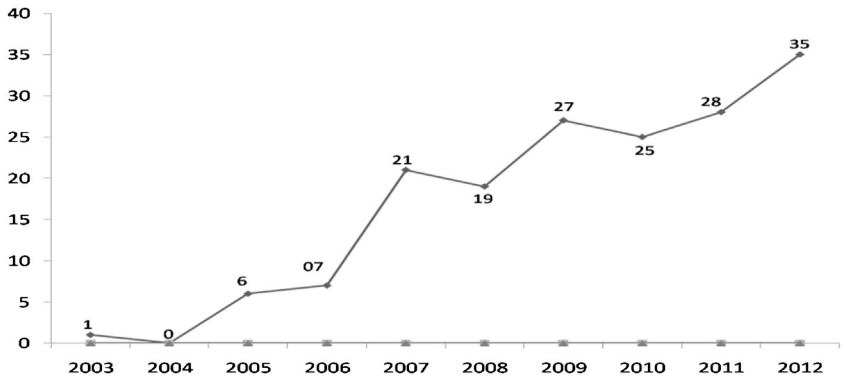

Fig. 6. Number of scarf pins the ten last.

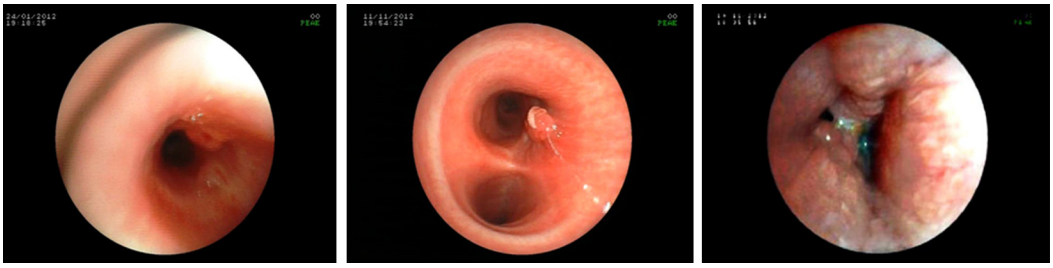

Fig. 7. Endoscopic aspects of granulomas.

not a real international consensus on the best protocol for general anesthesia applied for rigid bronchoscopy [10–13], this process allows the removal in a patient with spontaneous breathing and seems close to that related by Fidkowski in his review of 12,979 cases [13].

In 2/3 of cases, the accident occurs in children under 3 years of age mainly in males [1–4,10–21]. The frequency of the choking is variable [3–5,7,8,11–20], it is highly found when an adult is present during the event [16].

During the 1990s, the delay before removal was rarely less than 1 week. The number of children seen during the first 24 h still low even now, because of remoteness and parent's poor socio-economic conditions. In fact, it is not always a diagnosis delay but a treatment delay. Foltran et al. [1] like other authors [1,3,4,7] defined the delay of management by a threshold of 24 h and found this delay in 40% of 174 studies analyzed. In our experience, indeed, this threshold is too short and does not lead to more complications or removal difficulties [14] which could be seen if there is a delay of many days [20] however we believe that more precocious diagnosis of FB aspiration is, less difficult will be the removal.

Symptoms and signs often found are persistent cough, wheezing and unilateral reduction of vesicular murmur [1,12–14,16,17,19,20]. Giving a positive predictive value to these symptoms is justified [20] especially with organic FBs.

Chest radiography confirms the existence of radio-opaque FB in all cases and evokes the likelihood of FB aspiration if there is unilateral air trapping, mediastinal or subcutaneous emphysema. Sometimes these findings are combined. Pneumonia, pleural effusion, pneumothorax and destroyed lung are acute or chronic complications that revealed the accident in 13.06%. Once in ten, the chest radiography is normal. Other studies found 15–52% of normal radiography [1,4,11–13,16–19].

In our series, suffocating laryngeal and tracheal locations were not common (14%) but in these situations we advice to push the FB to one main bronchus (usually the right one) and as soon as the respiratory condition stabilizes, the FB is removed. The FB was often bronchial, mostly in the right main bronchus or the bronchus intermedius. However, it can be multiple and bilateral. Actually, this is not very important since all the bronchial tree is explored systematically.

Fig. 8. Ear of wheat transcutaneous migration in a patient.

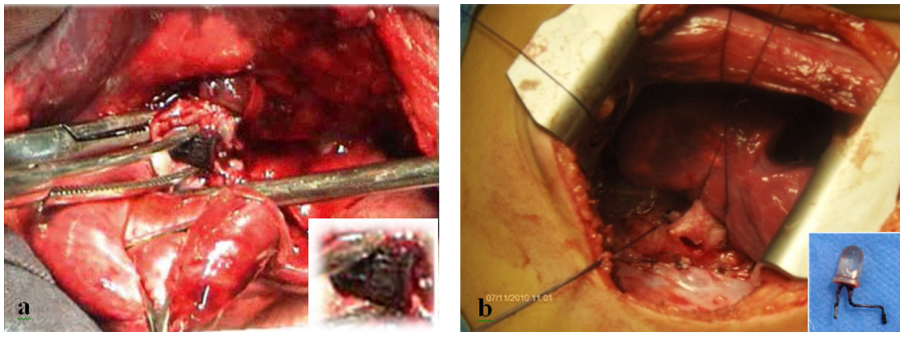

Fig. 9. Objects removed by thoracotomy: (a) pen cap and (b) bulb.

Table 6
Complications related to endoscopic procedure.

Complications	Number	%
Death (resistant hypoxemia)	7	0.26
Transient complications (hypoxemia, laryngospasm, bronchospasm)	75	2.85
Unilateral pneumothorax	2	0.07
Bilateral pneumothorax	1	0.04

FBs are that usually found in the Mediterranean area especially Maghreb countries [3,4,11,12,14–16,19,21–23]. We found organic FBs mainly peanuts and seeds, and various inorganic FBs such as pen caps and increasingly scarf pins.

In this study, some findings should be highlighted. Unsurprisingly, peanuts are the leading FB. Many peanuts can be aspirated at once [21]. Sometimes, iterative bronchoscopies should be performed to remove residual fragments [14,18]. Severe clinical expression is noticed with sunflower seeds and beans probably because of mucosal injuries especially as beans inflate quickly so they must be removed as soon as possible. In contrast, ear of wheat aspiration is insidious and often diagnosed after a long delay by complications related to its migration to pleura [24,25], pericardium or peritoneum.

Various plastic FBs were removed. Their aspiration was not serious unless they blocked the larynx as it was emphasized by Bloom et al. [6]. Pen caps aspiration is common among schoolchildren and tend to wedge in bronchi, therefore surgery become necessary [26]. In our series, removal failed in 1 case.

This last decade, metallic FBs are dominated by scarf pins in Algeria. This accident is mainly related to wearing islamic headscarf. This was reported by middle-east authors in the 1980s, first in ladies [3,27] then in teenagers [3,28,29], whereas it was noticed in Maghreb only theses last years [5,7,30]. Our first case was performed in 2003, since then we compiled 169 patients.

Rigid bronchoscopy allowed us to remove almost all FBs (97%). We used surgery for 69 of 676 patients (10.2%) of inorganic FBs (metallic or plastic). Tracheotomy or thoracotomy was used 1.6–27% in literature [26–29,31].

In Algeria, mortality due to FB aspiration is not known in the absence of reliable reporting cases.

In this study, reversible moderate to severe complications related to the endoscopic procedure occurred in 2.9% with a mortality of 0.26%, close to 2.4% and 0.42% found in recent series of 9437 and 10,236 patients [13].

5. Conclusion

Foreign body aspiration is a public health problem in Algeria. Its frequency is high enough to alert health authorities. Characteristics of this accident are those of intermediate income countries with a wide range of foreign bodies. The increasing number of scarf pin aspirations with wearing of middle-east Islamic headscarf by our teenagers reflects the profound cultural change of our population one or two generations after the independence.

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