



Research Article

Foreign Bodies in the Airway in Children: Experience in Argentina

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Abstract

Objectives: Foreign body aspiration is a serious and preventable cause of morbidity and mortality in childhood. Considering that the type of foreign bodies varies depending on diet and custom of each population, the aim of the current paper is to present foreign body aspiration cases treated in three Argentinian pediatric hospitals and to emphasize the need for preventive strategies and necessity of increasing community and healthcare professionals' knowledge about this problem.

Methods: A study on Argentinian retrospective and prospective cases of foreign body in the airways collected in the Susy Safe registry was performed. Data regarding: gender, age, localization and type of foreign body, elapsed time from the event to the removal of the foreign body, extraction technique, complications, need for hospitalization, and circumstances of the event (adult presence, child's activity when the event happened) were evaluated.

Results: 295 cases have been recorded. The highest incidence occurred in children under three years of age with 52.2% of cases (number of cases: 154). The 58.6 % occurred in males, with a high presence of adults at the time of the aspiration (80.3 %). The 60% of the foreign bodies were organic, being seeds and peanuts the most frequently retrieved. Only in the 35.6 % of the cases (number of cases: 105) the foreign bodies were extracted within 24 hours. Hospitalization occurred in 64.7% of cases.

Conclusions: A high presence of adults at the time of foreign bodies' aspiration was observed, showing that primary prevention has a key role to prevent such injuries. The need to implement further information on the foreign body type and

characteristics is essential to better identify risk foods and objects, and to develop effective methods of prevention. A communication initiative is under development in Argentina, aimed at informing parents and supervisors of the risks posed by common objects to their children's health.

Keywords: Aspiration; Children; Foreign bodies; Injuries; Primary prevention

Abbreviations:

FB: Foreign Body; ENT: Ear, Nose and Throat; P: Patient; N: Number of cases

Introduction

FBs aspiration is a serious and preventable cause of morbidity and mortality in childhood [1]. It is the fourth leading cause of accidental death in children under 3 years of age and the third in children aged 1 month to 1 year. Diagnosis and early management are essential for decreasing both the risk of mortality during the acute episode and complications arising from the permanence of a FB in the airway [1].

FB type varies depending on diet and custom of each population. The Susy Safe Registry is an international project established in order to create surveillance systems on FB's ingestion and aspiration injuries, identifying FB's type and characteristic through data collection [2].

Project objectives are to provide a safety mechanism by indicating high risk profile products and to promote educational programs.

The present study presents 295 new cases collected in Argentina, in the framework of the Susy Safe program which guarantees a ready-to-use data collection platform, and a common standard in data collection improving the communicability of results abroad and within the country.

Materials and Methods

Sample

The evaluation was carried out on 0-14 years children with FB in the airway, attended by Respiratory Endoscopy Units of three Argentinian hospitals: Pediatric Hospital "Prof. Dr. Juan P. Garrahan" (Buenos Aires), Children's Hospital "Dr. Ricardo Gutiérrez" (Buenos Aires) and Children's Hospital "Dr. Orlando Alassia" (Santa Fe), recorded in the Susy Safe Registry between April 2010 and April 2012. The main referent in each Hospital was an ENT Doctor.

Statistical methods

The analysis was carried out on retrospective and prospective hospital cases recorded for FB injuries in airway, registered in the Susy Safe database and validated as proper for quality and consistency of data.

Cases are prospectively collected from 06/2005. Retrospective cases are past consecutive cases available in each center registry and shared with the Susy Safe database. Descriptive statistics about the age and the gender of injured children were worked out. Data regarding FB type,

removal technique used, elapsed time from the event to the removal of the FB, adult supervision, child's activity when the event happened, complications and hospitalization were also evaluated. Odds ratios for FB localizations were computed. Analyses were performed using Design and Hmisc libraries from R version 2.8.

Results

A total of 295 patients have been recorded, 173 were male while 122 were female, 37 days to 14 years old. The highest incidence occurred in children under 3 years with 52.2% of cases (n: 154). Within this group, 117 children were between 1-3 years old.

The localization was in the bronchial tree in the 79.7% of cases (n: 235), the incidence of the right side (n: 129) was higher than the left side (n: 106), followed by tracheal (n: 41) and laryngeal (n: 19) localization (Figure 1).

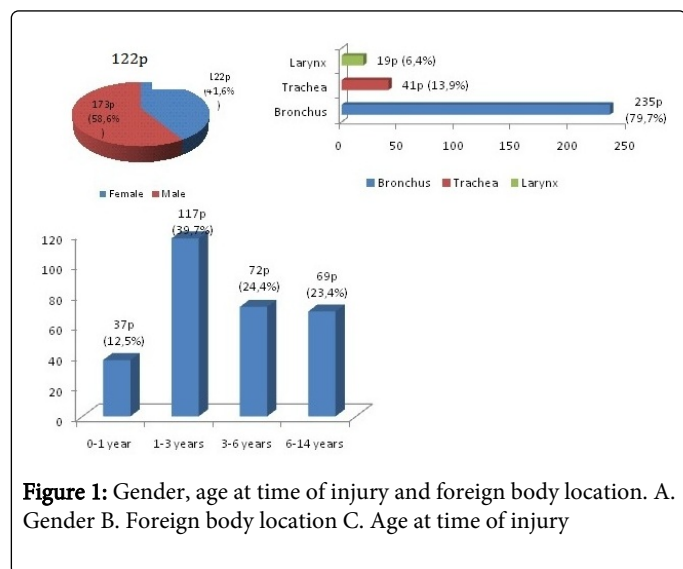


Figure 1: Gender, age at time of injury and foreign body location. A. Gender B. Foreign body location C. Age at time of injury

The 60% (n: 177) of the FBs were organic, among those the most common were sunflower seeds (n: 72) and peanuts (n: 55) whereas among inorganic item the most common were ballpoint pen caps (n: 25), followed by parts of toys (n: 20) (Table 1 and Table 2). The average age of patients injured by sunflower seeds and peanuts FB was of 3 years and 2.7 years respectively while for ballpoint pen caps and toy's parts FB it was of 8.1 years and 5.2 years respectively.

Organic FB	N°	%
Sunflower seeds	72	40,7
Peanuts	55	31,1
Food	12	6,7
Other sedes	10	5,6
Corn	8	4,5
Beans	4	2,3
Nuts	3	1,7
Thorn	3	1,7
Bones	3	1,7
Candy	2	1,1

Hazelnuts	1	0,6
Almonds	1	0,6
Other	3	1,7
Total	177	100

Table 1: Organic Foreign Bodies in the larynx, trachea and bronchi

Inorganic FB	N°	%
Biro lids	25	21,2
Toys	20	16,9
Pins and needles	11	9,3
Bullet	10	8,5
Thumbtacks	9	7,6
Jewellery	7	5,9
Plastic	5	4,2
Metal	5	4,2
Screws	4	3,4
Cloves	3	2,6
Stones	3	2,6
Other Sharp	3	2,6
Teeth	2	1,7
Female screws	1	0,8
Spring	1	0,8
Buckle	1	0,8
Other	8	6,9
Total	118	100

Table 2: Inorganic Foreign Bodies in the larynx, trachea and bronchi

The FB was retrieved within 24 hours after the event in 35.6% of cases (n: 105). Overall, 61 children (20.7%) were treated late, 15 days after the injury, and without suspected respiratory symptoms or were misdiagnosed in their place of origin, preventing the FB removal even for 6 and 18 months in 2 cases (Figure 2).

In 289 patients (98%) the removal was performed with a laryngoscope or rigid bronchoscope under general anesthesia within 24 hours of hospital admission. 1 patient had a previous attempt of extraction with flexible bronchoscope at the place of origin while 5 patients required a second bronchoscopy 4-9 days after the first one. In one case (0.3%) fibro-bronchoscope was used and only one patient required open surgery, after a failed attempt of using rigid bronchoscopy in both cases.

2 patients (0.7%) expelled the FB by coughing whereas in 2 cases the Heimlich maneuver was used.

Overall, 48 children (16.3%) had complications, the most common was pneumonia (n: 13), followed by granulomas (n: 10), mucosal erosion (n: 9) and severe respiratory distress (n: 9, of which 3 required intubation) (Table 3).

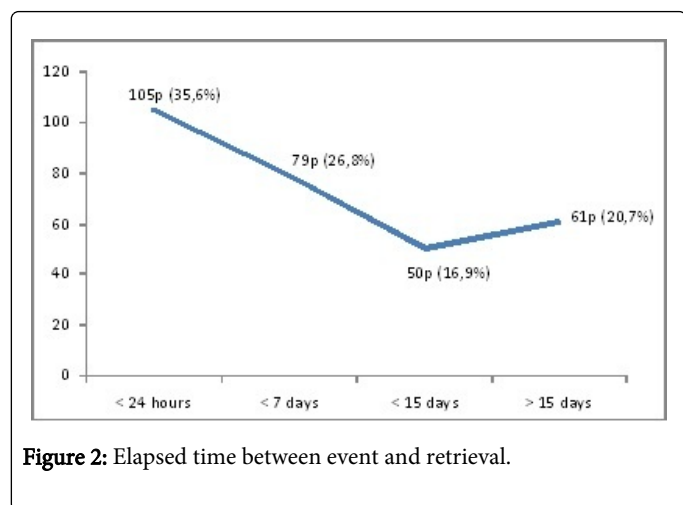


Figure 2: Elapsed time between event and retrieval.

Complications	N° of patients
Pneumonia	13
Granuloma	10
Respiratory distress	9
Mucosal erosion	9
Actelectasis	8
Subglottic stenosis	3
Seizures	3

Table 3: Complications

A total of 191 children (64.7%) were hospitalized 1 to 47 days (169 of them for less than 48 hours).

In 80.3% of cases (n: 237) an adult was present at the time the accident occurred. Most occurred while the child ate (n: 142) or played (n: 116).

Discussion

FB aspiration injuries are avoidable accidents, mainly observed in children under 3 years of age and causing significant morbidity [3-5]. There is a prevalence of boys [6] in our records 58.6% were male.

Children between 1 and 3 years old are most frequent victims for numerous reasons: curiosity, tendency to explore the environment through the mouth, immature swallowing coordination, and propensity to distraction and play while eating, and lack of cognitive ability to distinguish edible from non-edible objects.

Some of the FB is expelled through protective reflexes such as coughing or performing maneuvers. Nevertheless, a significant percentage of FBs remain in the airways, obliging the patient to refer to a clinic or to the family doctor.

The localization depends on size and shape of the FB and the position of the child during inhalation [7]. In our sample in 79.7% of cases it was lodged in bronchus. Small sized FBs in children are more frequent in the right bronchus, due to its greater diameter, the wider opening angle between the right bronchus and the trachea, the carina

placed slightly on the left side, and the greater volume of air entering the right bronchus during inspiration. Differently from the present one, in our previous statistical study (until 1997) there was a predominance of FBs in the left bronchus [8].

FBs are mostly of organic origin [5,9,10] (60% of cases in our records). The FB type varies widely by country, according to cultural, socioeconomic, dietary patterns and age [8]. In the first years of life organic FBs are predominant, whereas starting scholastic education, stationery articles become more frequent [11].

Particularly, size, shape, type and site of lodging of the FB are responsible for an important variability on clinical picture: objects causing obstruction in the larynx and trachea are in fact potentially life threatening, while objects lodged more distally are frequently undiagnosed and retained and could cause severe complications including pneumonia, atelectasis and bronchiectasis [12]. Therefore, in order to understand the pathogenetic pathway and to disseminate knowledge in scientific community about this issue, the possibility to know details regarding object characteristics and traumatic event dynamics play a key role.

Diagnostic delay can be attributed to: initial misdiagnosis, lack of witnesses, children who do not admit aspiration for fear of being punished, or parents who fail to report a preceding choking event because they were not heard by doctors in previous consultation. In some cases delayed extraction was attributable to transfer necessity of the patient due to the lack of endoscopist in its place of origin.

Suspected FB aspiration, respiratory symptoms, auscultation and chest radiography are the fundamental factors that determine the indication for a rigid bronchoscopy under general anesthesia, which is the best diagnostic and therapeutic method in pediatric [3,5,11]. It is recommended within 24 hours of the accident (except in emergency cases), performed in optimal condition, with trained staff and proper equipment available [7,11].

Although rigid bronchoscopy is a safe procedure, it is not without risk. In our series there were no complications from the endoscopic procedure, nor tracheotomy requirements. 1 patient only required open surgery (thoracotomy) for the extraction of the FB (FB: needle). [3]., with FB spike, extraction lexible bronchoscope.

With regard to the virtual bronchoscopy: its availability, radiation exposure and obviously the fact that it does not solve the removal [7], moves it to the background.

The longer the FB is retained in the bronchial tree, the greater the possibility of complications, including bronchus FB mobilization and positioning in the larynx causing asphyxiation [3,8]. Moreover, endoscopic examination is hindered by the appearance of edema and granuloma impeding FB localization and facilitating bleeding during manipulation [4]. In these cases it is convenient to treat with antibiotics and corticoids, and retry after 48 hours [11]. In our series the need for second intervention corresponded to patients diagnosed after one month.

Overall, 191 patients were hospitalized; 88.5% for less than 48 hours. The short hospitalization period demonstrates the safety of the endoscopic procedure.

The most staggering retrieval in our analysis is the high frequency of adult's presence while the injuries happened. In 80.3% of all cases an adult was with the child who incurred in the accident that in most cases was either playing or eating. These data not only point towards a

worrying common trend in different countries [13-16] but also show how primary prevention in Argentina is still lacking an impact, towards an event that is not common as other injuries, like road traffic injuries that accounted for the 0.2% of all estimated deaths in 2008 among children aged 0-14 years in Argentina [17] but that might end more frequently in fatalities, especially when affecting the tracheobronchial tree as in our study [18].

Conclusions

FB aspiration is a serious and preventable cause of morbidity and mortality in childhood. The high presence of adults at the time of aspiration shows that primary prevention has a key role to prevent such injuries and parents and caregivers' education is fundamental.

Increasing information on FB type and characteristics (size, shape, consistency) allows better identification of risk foods and objects and permits to understand its pathogenicity, to determine the damage they can cause, and therefore to develop effective methods of prevention through knowledge dissemination in the scientific environment.

References

1. Reilly BK, Stool D, Chen X, Rider G, Stool SE, et al. (2003) Foreign body injury in children in the twentieth century: a modern comparison to the Jackson collection. *Int J Pediatr Otorhinolaryngol* 67 Suppl 1: S171-174.
2. Susy Safe Working Group (2012) The Susy Safe project overview after the first four years of activity. *Int J Pediatr Otorhinolaryngol* 76 Suppl 1: S3-11.
3. Rodríguez H, Passali GC, Gregori D, Chinski A, Tiscornia C, et al. (2012) Management of foreign bodies in the airway and oesophagus. *Int J Pediatr Otorhinolaryngol* 76 Suppl 1: 584-591.
4. Kiyan G, Gocmen B, Tugtepe H, Karakoc F, Dagli E, et al. (2009) Foreign body aspiration in children: the value of diagnostic criteria. *Int J Pediatr Otorhinolaryngol* 73: 963-967.
5. Oliveira CF, Almeida JF, Troster EJ, Vaz FA (2002) Complications of tracheobronchial foreign body aspiration in children: report of 5 cases and review of the literature. *Rev Hosp Clin Fac Med Sao Paulo* 57: 108-111.
6. Paksu S, Paksu MS, Kilic M, Guner SN, Baysal K, et al. (2012) Foreign body aspiration in childhood: evaluation of diagnostic parameters. *Pediatr Emerg Care* 28: 259-264.
7. Korlacki W, Korecka K, Dzielicki J (2011) Foreign body aspiration in children: diagnostic and therapeutic role of bronchoscopy. *Pediatr Surg Int* 27: 833-837.
8. Rodríguez H, Cuestas G, Ballali S, Sica G, Widmann W, et al. (2012) Foreign bodies injuries in children in Argentina: a countrywide program connecting evidence with prevention. *Open Pediatr Med Journal* 6: 16-22.
9. Botto H, Zanetta A, Nieto M, Rodríguez H, Tiscornia C (1997) Cuerpos extraños en las vías aérea y digestiva. *Medicina Infantil IV*: 166-72.
10. Sih T, Bunnag C, Ballali S, Lauriello M, Bellussi L (2012) Nuts and seed: a natural yet dangerous foreign body. *Int J Pediatr Otorhinolaryngol* 76 Suppl 1: S49-52.
11. Alvarez-Buylla Blanco M, Martínez Morán A, Alvarez Paredes I, Martínez Vidal J (2008) [Bronchoscopy in children with foreign body aspiration]. *Acta Otorrinolaringol Esp* 59: 183-189.
12. Sirmali M, Türüt H, Kisacik E, Findik G, Kaya S, et al. (2005) The relationship between time of admittance and complications in paediatric tracheobronchial foreign body aspiration. *Acta Chir Belg* 105: 631-634.
13. Chacon FS, Ballali S, Passali D, Cuestas G, Burbano G, et al. (2011) Epidemiology of foreign bodies injuries in Ecuador: a first look based on a single centre experience. *Int J Pediatr Otorhinolaryngol* 75: 854-857.



Figure 3: The general version of the poster meant for advising parents and supervisors of the risks posed by common objects in terms of choking, ingestion or insertion in the upper orifices.

Primary prevention is therefore seen as a key to avoid those kinds of injuries. Particularly, active strategies that promote behavior change are necessary. Active strategies require that a caregiver changes his or her behavior each time the child begins an activity that has the potential to cause injury. Education is critical to these active strategies and plays a complementary role to environmental changes and legal mandates [19] and information on age-appropriate foods and about safe behaviors should be included in all visits to pediatricians in order to make parents able to be recognize potentially dangerous products, identify risky situations and better control children access to hazardous objects. An initiative, based on a poster, aimed at being displayed in Hospital and Schools has been developed as a product of this joint initiative (Figure 3). The poster is targeted to parents and adult supervisors, to make them aware of the risks posed by common objects in terms of choking, ingestion or insertion in upper orifices to their children.

Education of doctors involved in the initial treatment is essential in order to reduce subacute and chronic complications resulting from the delay of the FB removal.

14. Endican S, Garap JP, Dubey SP (2006) Ear, nose and throat foreign bodies in Melanesian children: an analysis of 1037 cases. *Int J Pediatr Otorhinolaryngol* 70: 1539-1545.
15. Paul SP, Hawes D, Taylor TM (2010) Foreign body ingestion in children: case series, review of the literature and guidelines on minimising accidental ingestions. *J Fam Health Care* 20: 200-204.
16. Gregori D, Foltran F, Cuestas G, Rodríguez H, Passali D, et al. (2012) Foreign bodies in non-life threatening locations: a risk analysis of nose and ears foreign bodies in European children. *Open Pediatr Med Journal* 6: 23-28.
17. WHO (2004) *The Global Burden of Disease*.
18. Fraga AM, Fraga GP, Stanley C, Costantini TW, Coimbra R (2010) Children at danger: injury fatalities among children in San Diego County. *Eur J Epidemiol* 25: 211-217.
19. Deal LW, Gomby DS, Zippiroli L, Behrman RE (2000) Unintentional injuries in childhood: analysis and recommendations. *Future Child* 10: 4-22.