Foreign Bodies in Non-Life Threatening Locations: A Risk Analysis of Nose and Ears Foreign Bodies in European Children

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Abstract: Children with a foreign body (FB) in either the ear or nose commonly present to the hospital. We present a retrospective series of 1186 European cases of FB in ears or nose in children younger 14 years old, classified following the International Classification of Disease (ICD931 and ICD932). Data were collected through a case report form (CRF) during three years (2000-2002) according to four main characteristics (socio-demographic, ergonomic, related to the hospital's management and to the circumstance of the injury). Overall, 610 (53%) sampled children were males. In 704 (71%) of cases, FBs were inorganic and among themabout 36% were balls, marbles or beads. The study investigates FBs featuresand injuries circumstances that are associated to prolonged hospitalization and complications. The most dangerous FBs resulted in objects with rigid or semi-rigid consistency.

Keywords: Foreign body (FB), children, chocking, ears, nose.

INTRODUCTION

Foreign body (FB) insertion, ingestion, aspiration and inhalation is a common and serious problem among children in pediatric age. Unlike FB inhaled into the lower airway [1, 2] or ingested [3, 4], the presence of a foreign body in the ear or nose is not life-threatening, but it may result in significant morbidity [5-8].

Nasal foreign bodies (NFBs) are commonly observed in pediatric setting since boredom, curiosity, interests in exploring their bodies make children more prone to lodging foreign bodies (FB) in their nasal cavities [9].

In scientific literature a wide spectrum of foreign bodies has been documented and, most frequently, FBs are identified as toys, sweets, jewels, rocks, batteries, and magnets. The presence of a FB in the nose is not usually life threatening [10], however, it may result in long-term complications and it could be responsible even of fatal outcomes if the object is dislodged into the airway. Foreign body (FB) insertion in external auditory canal (EAC) is not an uncommon event in emergency medicine [7]. Several factors in fact may lead children to insert foreign bodies intentionally into the ears including curiosity, the wish to explore the orifices of the body, fun-making, irritation caused by otalgia and attraction to small, round-shaped objects [11, 12].

Although not life-threatening, the placement or presence of foreign bodies in the ear canal and their subsequent removal can be a source of significant morbidity. This is particularly true in children because of smaller anatomic dimensions and a variable level of cooperation [13].

Despite the frequency and potential morbidity circumstance there is very little literature based on large series of ear foreign bodies in children [11, 14].

Because of the risks associated with FB injuries, public health authorities must to devote great attention to this issue [10] and joint efforts, including the implementation of surveillance systems such as the Susy Safe Registry [15], have been made in several countries to better understand the injuries due to the FB insertion or inhalation and to identify shared prevention standards. Particularly, the integration of information coming from different clinical setting and cross-cultural comparisons constitute a cornerstone of a monitoring activity aiming to identify risky FB and hazardous behavior, in order to implement normative and educational preventive strategies.

Unfortunately, while in scientific literature several papers describe clinical management of FBs [11, 16-19], data on follow up of patients after the foreign body extraction and thus on long terms outcomes are almost absent [20].

Based on a database of foreign body injuries, which occurred in European children aged up to 14 years in 2000-

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§Dario Gregori, Hugo rodriguez and Paola Berchialla are Guest Editors for the Issue.

1874-3099/12 2012 Bentham Open

2003, this paper will focus on the cases regarding ICD codes 931 (FB inside the ears) and 932 (FB inside the nose) to evaluate the causes of prolonged hospitalization and complication.

MATERIALS & METHODS

The European Survey of Foreign Bodies Injuries (ESFBI) is a retrospective study, aimed at collecting a great case database concerning FB injuries in the upper airways (the accidents referred to the International Classification of Disease, ICD-codes), as regards to European children, aged 0-14 The discharge records from 19 European hospitals were reviewed. Data were gathered in the capitals' hospitals of 19 countries (Spain, United Kingdom, Germany, Switzerland, Austria, Italy, Belgium, Denmark, Finland, Sweden, Croatia, Slovenia, Greece, Slovakia, Czech Republic, Romania, Bulgaria, Turkey, Poland) and referred to the period starting from January, the 1st, 2000 and December, 31st, 2002 (whether available, also data from 2003 were considered).

Accidents, caused by the inhalation/ingestion/aspiration/ insertion of FBs, were collected using a standardized Case Report Form (CRF).

The CRF encompassed four main aspects of the FB injuries: the characteristics of the children (age, gender), the characteristics of the object (shape, consistency and dimension), circumstances of injury (presence of parents, activity) and hospitalization details (length of stay in hospital, complications).

The coordinating centre received the data and made the quality case control in collaboration with the European Federation of Oto-Rhino-Laryngological Societies (EUFOS) board. Dedicated doctors checked for all cases that presented not sufficient integrity and accuracy, such as those records with discrepancies among the birth date of the injured child and the accident date or missed completion of mandatory fields [21].

Two outcomes were identified: (*i*) complications and (*ii*) prolonged hospitalization, which was defined on the basis of the length of stay(LOS) of 3 days, at least.

Descriptive statistics of the study sample were done using percentages and absolute numbers. Prolonged hospitalization and complications were analyzed using odds ratios and related 95% confidence intervals. Analyses were performed using R version 2.8 and Hmisc and Design libraries [22].

RESULTS

A total of 1186 European children had a foreign body injuries with the FB located in ears or nose. Among them, 51%

Table 1. Distribution of Complications and Hospitalization by Age, Gender, FB Removal Technique, Type of Admission and Adult Presence and FB Features

	N	Complications			Prolonged hospitalization		
		No	Yes	OR (95%CI)	<3 Days	≥ 3 Days	OR
		N=929	N=124		N=134	N=7	
Age class: <1	1178	1% (6)	1% (1)	0.82 (0.10; 6.91)	2% (2)	0% (0)	NS
1-3		53% (487)	29% (36)	0.36 (0.24; 0.55)	41% (54)	14% (1)	0.49 (0.06; 4.22)
>3		47% (429)	70% (87)	Ref	58% 76)	86% (6)	Ref
Gender : Male	1164	53% (485)	54% (66)	1.03 (0.71; 1.51)	53% (69)	14% (1)	0.23 (0.03; 2.00)
FB removal technique:	1061						
Endoscopy		60% (555)	33% (41)	Ref	9% (12)	29% (2)	Ref
Operation		14% (127)	9% (11)	1.17 (0.59; 2.34)	76% (101)	29% (2)	0.12 (0.02; 0.92)
Other		26% (244)	58% (72)	3.99 82.65; 6.03)	15% (20)	43% (3)	0.90 (0.13; 6.18)
Regime of hospitalization	1186						
Day Hospital		21% (105)	29% (8)	2.79 (1.07; 7.24)	75% (100)	71% (5)	0.50 (0.05; 4.71)
Emergency Service		74% (366)	36% (10)	Ref	7% (10)	14% (1)	Ref
Ordinary		5% (25)	36% (10)	14.64 (5.57; 38.45)	18% (24)	14% (1)	0.42 (0.02; 7.34)
Adult presence	1186						
Adult present		35% (287)	39% (43)	1.16 (0.77; 1.75)	40% (48)	0% (0)	NS
FB type: Inorganic	1186	70% (653)	65% (81)	0.80 (0.53; 1.19)	78% (104)	100% (7)	NS
FB consistency : Conforming	1034	18% (164)	24% (29)	1.42 (0.88; 2.27)	19% (24)	0% (0)	NS
Do not know		2% (21)	1% (1)	0.38 (0.05; 2.89)	0% (0)	0% (0)	NS
Rigid		57% (513)	53% (64)	Ref	61% (78)	86% (6)	Ref
Semi-rigid		23% (205)	22% (27)	1.06 (0.65; 1.70)	20% (25)	14% (1)	0.52 (0.06; 4.53)
FB shape : 2D	993	7% (65)	11% (11)	2.24 (1.09; 4.60)	6% (8)	0% (0)	NS
2D circle		7% (64)	9% (9)	1.86 (0.86; 4.03)	7% (9)	14% (1)	NS
3D		18% (156)	43% (45)	3.82 (2.39; 6.10)	31% (38)	43% (3)	1.74 (0.33; 9.04)
other		10% (90)	1% (1)	0.15 (0.02; 1.08)	2% (3)	0% (0)	NS
Spherical		57% (503)	37% (38)	Ref	53% (66)	43% (3)	Ref
FB volume	453	33.49 113.04 267.95	33.49 65.42 152.5	0.83 (0.66; 1.03)	6.0 18.0 40.0	30.87 33.49 80.37	3.91 (0.99; 15.48)

Number after percents are absolute frequencies. For volume, I quartile/median/III quartile are reported. N is the number of non missing values. Odds ratio (OR) and 95% confidence interval were reported.

were between 1-3 years old; 53% were males, according to previous studies [23, 24], which report a slightly higher incidence of FB injuries among males (Table **1**).

Nineteen different objects were retrieved. Among them, 70% were inorganic, 55% had a spherical shape and 57% had a rigid consistency with volume ranging from 14 to 800 mm^3.

Regarding the activity played by children immediately before the accident, playing is the most frequent (82%); also in the 64% of cases, adults were absent.

Among injured children, 86% did not require hospitalization; in the 34% of cases the foreign body was removed using endoscopy in Emergency Service.

Overall, 11% of the children experienced complications. The most frequent complication was inflammation of external meatus and perforation of tympanic membrane and infection of nasal mucosa.

Surgery removal techniques showed anot significantly increased risk of complications than endoscopy (OR=1.17; 95% CI: 0.19-2.34); whereas 3D objects showed a significant increased risk of complicated injuries (with respect to spherical shaped foreign bodies) (O.R.=3.82, C.I. 2.39-6.10). Children older than three years old were at significantly greater risk of prolonged hospitalization (Table **1**).

Inorganic foreign bodies were encountered more often in case of prolonged hospitalization (Table **1**). Indeed they resulted associated with spherical and 3D shaped object and with rigid and semi-rigid consistency, which posed major risk of complicated injuries (Table **3**).

A multivariable analysis for selecting predictors of prolonged hospitalization and complications was carried out. Shape and volume of the FB inserted its consistency along with organic/inorganic distinction, age and gender of the injured child, presence of complications (whether considering prolonged hospitalization as outcome) and the removal technique was considered as covariate for logistic regression model. After a backward selection procedure, age and shape of FBs were the only significant variable for predicting prolonged hospitalization and presence of complications (Table **3**). In Fig. (**1**), probability of experiencing complications and having prolonged hospitalization is showed as function of age in the case of injuries due to 3D foreign bodies.

Table 2. Foreign Bodies Features According to Inorganic/Organic Distinction

	N	Inorganic	Organic	Test Statistic
		N=825	N=346	
Shape : 2D	993	5% (36)	15% (41)	P<0.001
2D circle		9% (62)	5% (14)	
3D		20% (143)	21% (59)	
other		6% (43)	15% (43)	
Spherical		60% (420)	44% (121)	
Consistency: Conforming	1034	11% (79)	39% (114)	P<0.001
Do not know		0% (0)	5% (16)	
Rigid		70% (513)	23% (69)	
Semi-rigid		19% (137)	32% (95)	
Volume	453	33.49 113.04 267.95	54.0 82.0 189.	P=0.77

Test used: Chi-square test for shape and consistency and Wilcoxon test for volume.

Table 3. Multivariable Model for the Predictors of Complications and Prolonged Hospitalization

Factor	Complications			Prolonger Hospitalization		
	OR	95% CI		OR	95% CI	
Age	3.19	1.67	6.09	1.76	0.14	22.81
Shape						
2D:Spherical	2.34	1.12	4.92	0.01	0	1.07E+22
2D circle:Spherical	1.83	0.83	4.01	3.58	0.3	43.52
3D:Spherical	4.17	2.57	6.75	1.49	0.27	8.25
other:Spherical	0.15	0.02	1.13	0	0	4.31E+40
Consistency						
Conforming: Rigid	1.34	0.74	2.43	-	-	-
Semirigid:Rigid	1.01	0.59	1.71	0.50	0.05	5.32

Predictors were chosen with backward selection after entering all variables in the model.

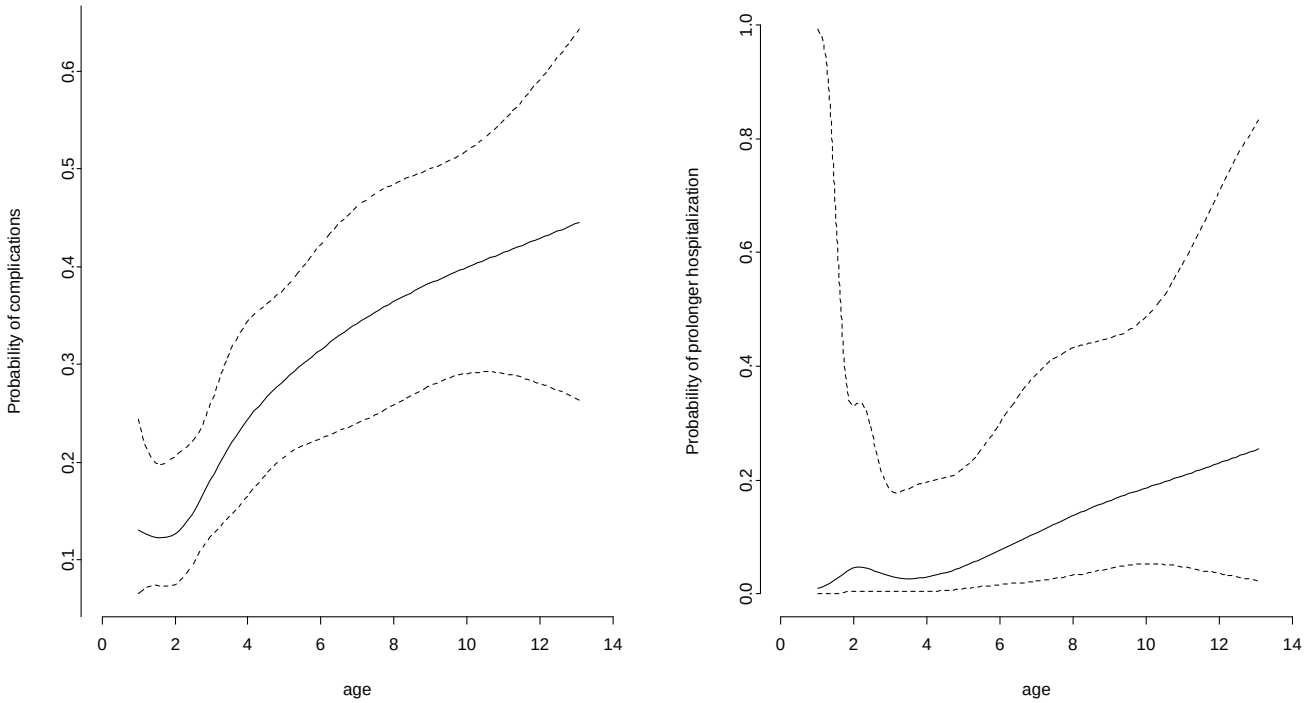

Fig. (1). Probability of experiencing complication (left) and prolonged hospitalization (right) as function of age for injuries due to 3D rigid foreign bodies.

DISCUSSION

Inhalation and aspiration of foreign bodies maintain their connotation of high prevalence cause of injury in children. Unfortunately, FB injuries are a neglected epidemic and there's a lack of sensibility in terms of recognition and acknowledgement of the FB injury risk; the constant evolvement of the FB typology, as new products reach the market, makes the information on product specific hazard and symptoms scattered; moreover, in most of the cases the diagnosis is difficult since symptoms are absolutely a specific [25].

Particularly, foreign bodies in the nose and in the ears produce local inflammation which may result in a pressure necrosis and damage the surrounding structure [26]. Nasal symptoms are mainly caused by inflammation, mucosal damage and extension into adjacent structures and could include sneezing, epistaxis, nasal obstruction, nasal discharge, pain, and eventually rhinosinusitis. Similarly, a FB in the ear may result in significant morbidity because of the small anatomic size and delicate skin of EAC and the thinness of the tympanic membrane [27].

In our case series the most frequent symptoms was bleeding and infections of external ear and nasal mucosa constituted well documented complications.

As observed elsewhere, the first determinants of a damage requiring hospitalization are the age of the child and the shape of the object; on the opposite, differently from the most common findings, food and organic FB appear to be less dangerous than inorganic FB, whose relative inert nature is believed to imply a mild tissue inflammation and a relatively quick response of the patient upon removal [28]. However, inorganic FB more frequently than food have shape and consistency identified as risky in our analysis

Adult presence is not sufficient to prevent hazardous situations: in our experiences almost 90% of injuries happen under adult supervision stressing the evidence that preventive strategies imposing a regulation of industrial production, even if fundamental, are not sufficient and need to be integrated with other preventive intervention, addressed to improve parents consciousness and attention toward a proper surveillance of children.

Consciousness toward foreign body injuries in children is needed also in order to address the problem from the public health perspective. In fact, the economic impact of hospitalization and complication of FB injuries on public health costs [29] confirms that FB injuries need a public health approach to be tackled effectively.

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ACKNOWLEDGEMENT

None declared.

CONFLICT OF INTEREST

None declared.

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Received: January 11, 2012 Revised: February 15, 2012 Accepted: February 15, 2012