



# PARENTAL AWARENESS OF THE DANGERS OF FOREIGN BODY INHALATION IN CHILDREN

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**ABSTRACT** – Background: The presence of a foreign body in the airways is a life-threatening condition and thus a medical emergency that requires timely diagnosis and treatment. If not recognized, it can lead to a number of serious complications. It is of the utmost importance to raise public awareness and educate parents and other caregivers on all aspects of this topic.

**Methods:** This observational cross-sectional study aimed to investigate parental awareness of the dangers of foreign body aspiration. To determine the current level of knowledge of the parents, a 14-question questionnaire was designed and filled out by parents of children under 5 years of age referred for their regular check-ups.

**Results:** The results show that majority of parents know that inhaling a foreign body is a potentially life-threatening condition and recognize which objects have a potential to cause foreign body aspiration. 36.9% of respondents said they knew what the symptoms of foreign body aspiration were, however only 15.6% offered a complete answer. 59.6% of the respondents could not specify the right course of action in case FBA occurred. 2% responded accurately. No statistically significant correlation was found between the number of children in the family nor the age and the sex of the parents and the level of knowledge about the aspiration of foreign bodies.

**Conclusion:** This study indicates that parents are insufficiently informed on recognizing foreign body aspiration symptoms as well as providing first aid. Media-assisted campaigns and the internet are potential sources of easily accessible educational material.

**Key words:** *Foreign body aspiration; Public health; Prevention; Pediatric*

## Introduction

The presence of a foreign body in the airway is a life-threatening condition and a medical emergency that requires timely diagnosis and prompt treatment.

Children aged 1-3 years are characterized by the need to investigate their surroundings by placing objects in their mouth and due to anatomical characteristics of the pediatric airway and underdevelopment of dentition, and are at greatest risk of foreign body aspiration<sup>1</sup>. Clinical presentation is variable. The most common symptoms indicating the possible presence of a foreign body include sudden onset of suffocation, coughing, stridor, cyanosis and/or dyspnoea, followed by a latent

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asymptomatic period<sup>2</sup>. According to one study, foreign body aspiration remains unrecognized in 30–50% of cases, which often leads to delayed diagnosis, despite the presence of acute symptoms<sup>2,3</sup>. With a prolonged presence of a foreign body in the airways, there is a recurrence of initial symptoms and frequent complications in the form of obstructive bronchitis, recurrent bronchopneumonia, emphysema and atelectasis. Late complications such as pneumonia, pneumothorax, mediastinitis, lung gangrene, or pulmonary abscess are also possible<sup>4,5</sup>. In order to reduce the incidence of foreign body aspiration and prevent complications, emphasis should be placed on prevention. Therefore, it is important to raise public awareness and educate parents and caregivers about risk factors and behavior that increase the risk of aspiration of a foreign body as well as the correct way of providing assistance to children in the event that aspiration occurred.

Our study was designed to assess parents' awareness regarding foreign body aspiration via questionnaire. The aim was to gain insight into the level of parental awareness and discuss developing improved individualized educational programs as well as preventive measures.

## Patients and Methods

This observational cross-sectional study was conducted by the departments of Otorhinolaryngology and Head and Neck Surgery and Pediatrics at a tertiary academic center in the period from July 2020- until November 2021. The patients and the public were not involved in any way in the design, or conduct, or reporting, or dissemination plans of this research. The study included 352 participants –inclusion criteria were met if the parents of children <5 years of age referred for clinical examination due to various indications were willing to provide written informed consent and fill out an anonymous questionnaire consisting of 14 questions designed to examine their current knowledge of the causes and symptoms of foreign body aspiration along with the correct course of action in the

case that aspiration occurred (Supplemental material). The questionnaire also included questions regarding the age and the sex of both parents and their children in order to examine the existence of a correlation between these factors and the level of knowledge about the aspiration of foreign bodies.

The total score on the questionnaire was formed by simply summing up the correct answers. Nine questions were answered positively (ie I know) which carried 1 point each and negatively (ie I do not know), which carried 0 points each. The answers to two compound questions were positive (2 points), partially positive (1 point) and negative (0 points). The question that required an extended answer (list the symptoms of foreign body aspiration) was subjectively scored 0 (missing answer), 1, 2, or 3 points, depending on the accuracy of the answer. The question of the procedure during the aspiration of a foreign body (question number 11) was analyzed separately and was not included in the total number of points. According to the above, the minimum theoretical number of points was 0 and the maximum was 16. The *Kolmogorov-Smirnov normality test* was used to examine the distribution of variables. Deviation of distributions from normal could be an obstacle to the use of parametric tests. By the use of Kolmogorov-Smirnov test we can conclude that our distribution of total results differs from the normal one. However, Petz (2004) states that the prerequisite for using parametric statistics is such that the distributions are not bimodal or in the form of a U-curve. By visual inspection of the observed results (Graph 1), we can sense that our distributions follow the curve of normal distributions to relatively high extent. Based on the results shown in the table, but also by visual inspection, it is clear that our distribution of results is negatively asymmetric. The observed negative asymmetry in the distribution of results is in line with expectations with regard to the content of the question, namely, most parents are aware of the danger posed by foreign body aspiration.

To check the reliability of the internal consistency of our questionnaire, we calculated Cronbach's alpha,

Used measure	k	RR	M	SD	K-S	Skewness	Kurtosis
Parental awareness questionnaire	13	0-16	10.94	2.83	0.122**	-0.46	-0.41

Note: K= number of questions; RR=range of results; M= mean; SD=standard deviation; K-S=Kolmogorov-Smirnov z-value; \*= $p < 0,05$ ; \*\*= $p < 0,05$

\* we did not score the last question as it was regard propositions and suggestions made by parents

which was  $\alpha = 0.683$ . Reliability of this quantity is considered *acceptable* (by the literature,  $\alpha > 0.6$  is considered acceptable). Inspection of individual questions on the questionnaire shows that the reliability of the internal consistency would increase to 0.712 by removing the question “Should you try to remove a foreign body with your fingers from the oral cavity of a child in whom you suspect inhaling foreign body occurred?”, so it would be advisable to consider use of this question in future research.

Statistical analysis was performed depending on the normality of the distribution using the T test for independent samples, the Pearson correlation coefficient and simple analysis of variance (ANOVA). All tests of statistical significance were performed using a two-sided 5% type I error rate. Statistical analysis was

performed using IBM SPSS Statistics for Windows, Armonk, NY: IBM Corp.) using standard descriptive statistics and frequency tabulation as indicated.

## Results

Out of a total of 352 respondents, there were 290 women (82.4%) and 45 men (12.8%) (16 did not state their gender), aged 20-54, with an average age of 32 years. The average age of children was 2,46 years (N=370). In our sample, the lowest number of points on a single questionnaire was 3 points and the highest was 16 points. The arithmetic mean was  $M = 10.94$  (SD = 2.83), (Graph 1).

Percentage display of responses (N=352) to the 9 questions presented in the questionnaire is displayed tabularly (Table 1).

Table 1. Percentage display of responses (N=352) to the 9 questions presented in the questionnaire

Questions		YES	NO
1.	Did you know that peanuts and nuts can cause a foreign body to inhale in a child?	90,3%	9,7%
2.	Did you know that corn, popcorn, beans and similar legumes can also cause foreign body aspiration?	85,2%	14,8%
3.	Did you know that small toys can cause a foreign body to be inhaled into a child?	95,2%	4,8%
4.	Did you know that foreign body inhalation is most common in children aged 0-2 years? (0.9% did not answer)	69%	30,1%
5.	Did you know that peanuts and nuts should not be given to children under 3 years of age?	76,7%	23,3%
6.	Did you know that you should be careful when taking out a toy to a small child who put it in his mouth while playing?	92,3%	7,7%
7.	Did you know that a child should not walk, run or jump while feeding?	84,1%	15,9%
8.	Should a child in whom you suspect inhaling a foreign body try to remove a foreign body from the oral cavity with your fingers?	49,1%	50,9%
9.	Do you think inhaling a foreign body is life-threatening for a child?	94%	6%

Out of all respondents, 32.9% of respondents did not offer an answer to the question to list the symptoms of inhalation, 51.4% of them recognized at least one of 3 symptoms: cough, discoloration of the skin or shortness of breath. Despite the fact that 36.9% of respondents said they knew what the symptoms were; only 15.6% offered a complete answer (Table 2, Graph 2).

Pearson's correlation coefficient was used to check whether there was a statistically significant correlation between the perception of symptom knowledge and the successful enumeration of foreign body aspiration symptoms. The correlation coefficient is  $r(352) = 0.63$ ;  $p < 0.05$ . We can therefore conclude that participants can assess their knowledge of symptoms. However, this correlation is moderate, which means that some of the participants fail to adequately assess their knowledge or the lack of it regarding the symptoms of foreign body aspiration.

Out of the total number of respondents, 37,5% knew about some of the procedures, but their answers were evaluated as incomplete or incoherent. Most of them recognize the importance of giving back thrusts while turning the child upside down and/or placing them on their stomach (13,9%).

So, although as many as 22.4% of parents report that they know the procedure when inhaling a foreign body, only 2% ( $N = 8$ ) successfully describe the procedure. Responses in which the respondents recognized the importance of inducing cough, if a child is able to do so, airway opening as well as differences in providing first aid considering the child's age were evaluat-

ed as correct (Table 2, Graph 3). Pearson's correlation coefficient was again used to determine whether there was a statistically significant correlation between the perception of knowledge of the procedure and the adequate response. Pearson correlation coefficient  $r(352) = 0.612$ ;  $p < 0.05$  signifies that some participants can assess their knowledge. The t-test for independent samples shows that there is no statistically significant difference in the number of points on the questionnaire between fathers and mothers, ie that fathers and mothers are equally aware of the danger of foreign body aspiration. The correlation coefficient between the age of the parents and their result on the questionnaire was  $r(352) = -0.32$ ;  $p > 0.05$ . Therefore, we can conclude that there is no significant correlation between the age of the parents and their awareness of the dangers of foreign body aspiration. We found no statistically significant correlation between the number of children in the family and parental awareness (Pearson's correlation coefficient  $r(342) = -0.053$ ;  $p > 0.05$ ).

## Discussion

Foreign body aspiration is the most common cause of death in children under 5 years of age, as a result of an accident at home, according to a study conducted in the United States (6). It is estimated that as many as 2.5 million children in the United States inhale a foreign body each year with the annual mortality rate of about 1% (7). A meta-analysis on foreign body aspiration revealed a higher incidence (60%) in favor of male children (1). More than 90% of foreign bodies are or-

Table 2. Percentage display of the responses ( $N=352$ )

Questions	YES	PARTIALLY	NO
1. Do you know what are the symptoms of foreign body inhalation in children?	36,9%	44,6%	18,5%
2. If so, what are the symptoms?	15,6%	51,4%	32,9%
3. Do you know what to do when you see or suspect that a child has inhaled a foreign body	22,4%	40,9%	36,6%
4. If you know, can you specify what is the right course of action?	2%	37,5%	59,6%

ganic, with peanuts being the most common (8,9,10). Foreign body aspiration is a relatively rare indication for emergency hospital admission, and the majority of patients were 3 years old (11). The exact incidence and mortality as a result of a foreign body aspiration are unknown. Available data suggests that most studies have focused on epidemiologic and demographic aspects of this topic. This study is different as it aimed to determine the parents' level of knowledge about the causes, symptoms and procedures in case of foreign body aspiration. So far, few similar studies have been conducted. We developed a questionnaire similar to one used by Higuchi *et al.*, but ours was expanded with questions to which respondents had to offer a descriptive answer (7).

The results show that the majority of parents know that inhaling a foreign body is a potentially life-threatening condition and recognize which objects have a potential to cause foreign body aspiration. As the respondents were only given a binary possible answer, these questions could be considered as indicative. A lower level of information was observed in questions focused on epidemiology and behaviors that increase the risk of inhalation of a foreign body. According to data from the "Susy safe project" registry, 86 % of cases of foreign body aspiration occurred while children were playing, and in 30% of cases, adults were present (12). It is concerning that in our study, as many as 15.9% do not know that the child is not allowed to walk, run or jump while feeding, and as many as 23.3% of respondents do not know that peanuts and nuts should not be given to children under 3 years of age. Around half of respondents believe that if they suspect a foreign body inhalation, they should also try to remove it from the oral cavity. The results of a study conducted in Japan by Higuchi *et al.* are somewhat different and show that 95.7% of mothers know that small toys can be the cause of foreign body aspiration, however 20.2% did not know that peanuts and other nuts can also be the cause, and 48.1 % did not know that they should not give peanuts to children under 3 years of age.

Almutairi and Alharabi demonstrated that certain sociodemographic characteristics of parents are positively correlated with the level of knowledge. It was found that highly educated women, mothers of 1-3 children achieve better results compared to other respondents (13). However, our study did not take into account the level of education of the respondents and did not find a

statistically significant correlation between the age and gender of the respondents and the level of knowledge or the number of children in the family and the level of knowledge of the respondents. The possible reason for this is that we had a smaller share of male respondents and as well as respondents with more than one child. On the other hand, a study by Higuchi *et al.* identified being a mother with a first child as well as being a mother of a child younger than 12 months old as risk factors for a lack of knowledge, but there were no differences in results depending on the mothers' age, which is in line with our results in this study.

When it comes to questions about first aid in case of foreign body aspiration, 22.4% of parents believe they know what to do. The most common answers included turning the child upside down or placing them on their lap and patting on the back (11.6%), Heimlich's maneuver (3.1%) and foreign body extraction by hands (3.1%). We can conclude that some respondents partially know what to do in case they suspect that their child has inhaled a foreign body, but they lack knowledge about the sequence of procedures, the meaning of individual procedures and differences in the course of action depending on the child's age. We found that there is a statistically significant positive correlation between the participants' perception of knowledge of the procedure and the adequate response (Pearson correlation coefficient  $r(352) = 0.612$ ;  $p < 0.05$ ). However, only 2% offered an accurate answer, which was assessed on the basis of whether the answer included encouraging the child to cough, if possible, and the application of back/chest thrusts depending on the child's age. Similar correlation was demonstrated between the perception of symptom knowledge and the successful enumeration of aspiration symptoms (Pearson correlation coefficient is  $r(352) = 0.63$ ;  $p < 0.05$ ). A Total of 36.9% of respondents state that they know what the symptoms of foreign body aspiration are in children, nevertheless only 15.6% of them offered a complete answer to the next question: "If you know, can you list what these symptoms are?" A complete answer was evaluated as complete if included listing 3/3 of the symptoms (cough, cyanosis, aggravated breathing). The respondents are able to assess their level of knowledge to some degree, but the overall result shows that the surveyed population does not possess a level of knowledge about the symptoms or about the right course of action to the extent that would be considered as adequate.

Most cases of foreign body aspiration can be prevented, so it is most important that parents, guardians, caregivers, employees of educational institutions and all those who work with children, especially under 5 years of age, adopt a certain level of knowledge on this topic. Prevention can be observed through multiple levels. Primary prevention implies legal frameworks and regulations. The only countries which have developed regulations directed towards choking prevention are the United States and Sweden (14,15,16). Manufacturers of foods containing nuts should label the same products as a potential choking hazard for children under 3 years of age. (17). Secondary prevention involves educating parents and other caregivers about symptoms while tertiary prevention focuses on timely treatment in the event that aspiration has occurred (5). The CHOP community intervention trial study protocol was designed in Italy with the aim of educating families and teaching staff through the school system. Lectures intended for children and their parents or guardians on the dangers of aspiration of foreign bodies, could be implemented as part of the compulsory curriculum in schools (18). Given the obligatory primary and secondary education in our country, in this way a greater number of parents and children would be included in this educational program. Evaluation of a media campaign conducted through newspaper articles, television and medical educational programmes in community pediatric care centers in Israel in the 1980s, aimed at raising awareness of foreign body aspiration, showed a 35% reduction in the incidence of foreign body aspiration over a two-year period, which demonstrates the effectiveness of the media for educational purposes (19). Some countries, such as Canada, recognized the importance of the Internet as a medium available to the general population. BC Children's hospital in collaboration with the University of British Columbia (a BC Children's Hospital / UBC Initiative) have created an educational website that is publicly available and free and targets school-age children and all those who care for them with the aim of raising awareness of the dangers of foreign body aspiration (20). The University of Padua and the Garrahan Hospital of Buenos Aires have developed "SafeFood4Children", a project aimed at preventing food choking in children, by posting videos in which experts inform all caregivers on this topic (21). International coopera-

tion and exchange of experiences between experts is also important. For example, "The Global Injury Research Collaborative (GIRC)", founded as a NGO, serves as a register into which medical professionals can enter data about their patients who had suffered an inhalation event. The application then gathers data from medical professionals from all over the world and analyzes it in order to help prevent future injuries (22). These are just some of the examples of how expert verified information can be easily accessed by people if the governments alongside with healthcare professionals would point out the importance of investing in their own knowledge. The results of this research indicate an insufficient level of knowledge of parents about the dangers of inhaling a foreign body and thus the need to implement similar projects in order to raise awareness about this important problem.

The limitations of this study are that the questionnaire is not standardized for questioning the level of awareness of the dangers of foreign body inhalation, and the test was conducted in only one hospital and on a specific population of parents which makes generalizations of the wider population difficult.

## Conclusion

Most parents know about the potential causes of foreign body inhalation and that it is a potentially life-threatening condition, but they are nevertheless insufficiently informed about the symptoms of foreign body aspiration and the adequate course of action in case the aspiration has occurred. In the era of availability of information via the Internet and social networks, parents and care providers should have easy access to correct and complete information and promotional materials about foreign body aspiration. It is an indisputable responsibility of healthcare workers in terms of primary health care, primary pediatricians and community nurses, as well as educators to offer appropriate education about this condition.

## Conflict of Interest

The authors have no conflict of interest to disclose. The authors received no funding from private or public institutions for preparation of this manuscript. All authors have read the final version of the paper and agreed with it.

## Ethics approval:

This submission was approved by our institution's bioethical board adhering to the Ethical Principles for Medical Research Involving 'Human Subjects', adopted by the 18th World Medical Assembly, Helsinki, Finland, June 1964, and as amended most recently by the 64th World Medical Assembly, Fortaleza, Brazil, October 2013. (Approval number: 251-29-19-11-01-5).

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## Sažetak

## ISTRAŽIVANJE SVJESNOSTI RODITELJA OPASNOSTI UDAHNUĆA STRANOG TIJELA U DJECE

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Prisutnost stranog tijela u dišnim putevima predstavlja hitno i po život opasno stanje te samim time zahtijeva pravovremenu dijagnozu i liječenje. Strano tijelo, ukoliko ostane neprepoznato, može dovesti do brojnih ozbiljnih komplikacija. Od iznimne je važnosti podizanje svijesti javnosti te edukacija roditelja i drugih skrbnika.

Cilj ovog opservacijskog presječnog istraživanja bio je ispitati svijest roditelja o opasnostima aspiracije stranog tijela. Kako bi se utvrdila njihova trenutna razina znanja, izrađen je upitnik od 14 pitanja koji su ispunili roditelji djece mlađe od 5 godina upućene na redovite preglede.

Rezultati pokazuju da većina roditelja zna da je inhalacija stranog tijela potencijalno po život opasno stanje i prepoznaju koji su predmeti najčešćim uzrokom aspiracije. 36,9% ispitanika navodi da zna koji su simptomi aspiracije stranog tijela, no odgovor njih 15,6% evaluiran je kao točan. 59,6% ispitanika ne zna kako postupiti u slučaju aspiracije stranog tijela, dok je samo 2 % adekvatno odgovorilo. Nije utvrđena statistički značajna korelacija između broja djece u obitelji niti dobi i spola roditelja te razine znanja o aspiraciji stranih tijela.

Ovo istraživanje pokazuje da su roditelji nedovoljno informirani o prepoznavanju simptoma aspiracije stranog tijela kao i pružanju prve pomoći. Kampanje potpomognute medijima i internet potencijalni su izvori lako dostupnog obrazovnog materijala.

Ključne riječi: *Aspiracija stranog tijela; Javno zdravstvo; Prevencija; Pedijatrija*