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Food choking hazards in children

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ABSTRACT

Objectives: To review the literature on pediatric food choking risks, with the long-term goal of supporting legislation regulating the production, labeling, and distribution of high-risk foods.
Methods: A PubMed search (Keywords: choking, obstruction, asphyxiation, foreign body, food) was conducted in July–September 2010 with publication dates ranging from 1966 to 2010. *Study selection*: Articles related to pediatric foreign body aspiration (FBA) were selected by three independent reviewers. 1145 articles were initially identified. Abstracts were then screened utilizing a tool designed to isolate relevant pediatric choking events; this tool helped to only select abstracts which presented data on patients younger than 18 years of age who had choked on food items. Through this, a total of 72 pertinent articles were isolated (55 observational studies, 17 case reports/series). *Data extraction*: For each study, patient age, sex, foreign body location, presenting signs and symptoms, utility of radiographic studies, and type of foreign body detected in the majority of study participants were determined. A "majority" of patients for each study was predetermined arbitrarily to be 2/3 of the studied population.
Results: The majority of patients in each observational study was determined to be: male (87% of all studies) and age <5 years (95% of all studies). Aspirated foreign bodies were mostly detected in the right main bronchus foreign body (72% of all studies), and there were abnormal radiographic signs (81% of all studies) at the time of evaluation. Food-object foreign bodies were the most frequent factors associated with choking (94% of all studies).
Conclusion: Childhood aspiration of food-objects is a significant public health issue. Although there is substantial legislation regulating non-food items that pose a choking hazard, equivalent guidelines do not exist for high-risk foods. Our study identifies and confirms several risk factors for pediatric FBA events. In doing so, it echoes the concerns and suggestions of various groups in supporting the development of legislation which may reduce the incidence of food-object aspiration.

1. Introduction

Foreign body aspiration (FBA) continues to be a significant concern in the pediatric population, accounting for thousands of emergency room visits and greater than 150 deaths each year in the United States alone [1,2]. Frequently aspirated foreign bodies range from common foods to plastic toys or toy parts. One explanation for the prevalence of this problem among the pediatric population is that children less than three years of age have underdeveloped swallowing and narrower airways which may not permit expulsion of foreign objects by cough or the Heimlich maneuver. Additionally, the developing child will often place items into their mouths while exploring the environment and may not be attentive to the task of eating [3]. These characteristics place young children at a higher risk of suffering severe consequences such as brain damage or death from obstructive events [4]. Mortality rate can be relatively high, with some studies reporting a rate up to 3.4% among patients admitted for FBA [5].

Young patients are globally affected by FBA of food items, and cultural differences can affect a population's diet and the food introductory process. While the American Academy of Pediatrics Committee on Nutrition recommends that complementary foods be introduced into a child's diet no earlier than 4–6 months given that infants less than 4 months of age are not ready to process swallowing, various studies suggest that maternal ethnic group, education level, and social class can affect the timeframe of when parents introduce solid food into a child's diet. For example, one UK study demonstrated that white mothers were more likely to cease

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breast feeding and introduce solids earlier than most other ethnic minority groups [6]. Therefore, there is much variability on a global scale of how and when solid food is introduced as well as the amount of education parents may receive about avoiding FBA events.

Several educational resources do exist to help prevent FBA and to manage them when they do unfortunately occur. In addition, formal legislation to prevent FBA has existed since the establishment of the Federal Hazardous Substances Act (FHSA) in 1979, with numerous amendments to date [1]. Although these marketing regulations, surveillance systems, and legislative efforts have been created to regulate non-food products, the most frequently aspirated objects in young children and infants remain food items. Currently, federal legislature does not regulate the packaging, labeling, or manufacturing of food items. In 2010, the American Academy of Pediatrics (AAP) released a statement regarding the current inadequacy in addressing the dangers of food-related choking. They explained that the US Food and Drug Administration (FDA) should be responsible for a number of measures in this regard; food should be labeled appropriately to warn the public about choking risks, and related choking events should be thoroughly investigated. Additionally, food manufacturers could consider redesigning preexisting man-made food items to alter their dimensions in efforts to decrease the choking risk. Since certain foods have been identified to be more associated with asphyxiation than others, public health education and legislation can be appropriately targeted toward these particular items [3].

In an attempt to highlight this epidemiologic dilemma and to further justify the requirement for legislation regulating potentially dangerous food items, we have conducted a comprehensive and systematic review of the literature, focusing on FBA in the pediatric population. In doing so, we consolidated a large body of literature to present the associated sociologic and demographic patient data, aspirated foreign body specifics, radiographic findings, and clinical symptoms on presentation.

2. Methods

A systematic literature review focusing on articles related to foreign body aspiration in the pediatric patient population was conducted in July–September 2010. Articles were identified by performing a PubMed search (keywords: choking, obstruction, asphyxiation, foreign body, food). Three independent reviewers trained in critical review of the scientific literature then screened these abstracts for relevance. Full-text articles were obtained for each abstract, and these were further evaluated using a screening form designed to isolate articles of relevance to this literature review (Fig. 1).

For each relevant article isolated, information pertaining to several variables associated with the aspiration event was collected. This included the following: (1) Demographics of the studied population (age, gender), (2) anatomic location of the aspirated foreign body (right versus left main bronchus), (3) signs and symptoms on presentation (shortness of breath, other), (4) radiographic findings (suspicious for foreign body), and (5) type of foreign body aspirated (food; non-food; if food, seed/nut/legume or other).

Individual studies were evaluated to determine if the majority of patients in each study population suffered a foreign body aspiration event occurring in conjunction with any of the previously determined variables. The majority of study participants was defined as $\geq$2/3 of patients in each study. We combined data from the observational studies in order to better assess high risk foods on a larger demographic scale.

1. Is the study on human subjects?

- ❑ 1 Yes
- ❑ 2 No (stop)

2. Is the studied condition choking?

- ❑ 3 Yes
- ❑ 4 No (stop)

2a. Type of choking item(s)

- ❑ 5 Food
- ❑ 6 Non-Food (stop)
- ❑ 7 Both Food and Non-Food

3. Is the age of study population ≤ 18 years?

- ❑ 8 Yes
- ❑ 9 No (stop)

3a. Age group of study population

- ❑ 10 0-5 years
- ❑ 11 6-12 years
- ❑ 12 13-18 years
- ❑ 13 0-18 years – specify

4. Type of medical condition of study population

- ❑ 14 Craniofacial disorders including cleft palate
- ❑ 15 Neurological/ muscular disease
- ❑ 16 Other
- ❑ 17 Not applicable

5. Geography

- ❑ 18 United States/Canada
- ❑ 19 Europe - specify
- ❑ 20 Asia – specify
- ❑ 21 South or Central America or Mexico – specify
- ❑ 22 Africa- specify
- ❑ 23 Other – specify

6. Type of article/ study design

- ❑ 24 Editorial/Opinion/Commentary/Letter
- ❑ 25 Clinical Practice
- ❑ 26 Overview/Summary
- ❑ 27 Systematic Review
- ❑ 28 Parent Education Material
- ❑ 29 Case Report/Case Series
- ❑ 30 Observational Study

Fig. 1. Abstract screener.

3. Results

A total of 1145 articles were obtained by performing the initial PubMed search. After screening articles for relevance, 72 pertinent articles (55 observational studies and 17 case reports or case series) were isolated for analysis. In order to reduce the likelihood of drawing generalizations from isolated case reports or studies documenting rare events, data extracted from case reports and series were analyzed separately from those of observational studies.

Observational studies (Table 1): there were 13,072 patients in 55 observational studies of patients with FBA.

3.1. Patient demographics

Child gender: *The majority of patients were male.* Forty-seven of 55 studies reported child gender. 9756 patients with an FBA event were represented by these 47 studies. There was a male