

Choking Among Infants and Young Children

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Abstract

This retrospective study aims to determine the epidemiological features of deaths caused by choking among infants in one of the general teaching hospitals in Jordan with a focus on weaning practices and its relation to sucking as major factors underlying the mechanism of choking in infants and young children. The study utilized a retrospective design to review the records of forensic cases due to a foreign body aspiration examined at the forensic department at the Jordan University Hospital. A total of 27 cases of choking in the pediatric age group were retrieved from the reports of the autopsy cases dissected. All cases of children who died due to choking by foreign bodies were under 11 years old. Choking by food materials constituted (44.4%) of cases under 3 years of age while choking by non-food material was less prevalent under 3 years of age, comprising 18.5% of the cases. Health care personnel and parents need to be aware that the introduction of solid food, unlike exclusive breast or formula-milk feeding, can have serious consequences if occurring in inappropriate timing or consistency during early childhood physical and functional development. Parents need to be educated regarding the appropriate timing and process of weaning.

Keywords: Choking, Weaning Practices, Infants, Young Children.

1. Introduction

Adequate respiration and nutrition are essential throughout a lifetime. Breathing occurs spontaneously without requiring an active effort by infants. Eating, on the other hand, requires that the infant coordinate sucking, swallowing, and breathing at the breast or bottle (Kidsafe, 2006). The urge to suck and mouth by young children is a natural developmental phase (Norris and Smith, 2002). Yet, chewing and swallowing food do not come naturally to infants. They are complex behaviors, having both reflex and learned components. Infants must learn to coordinate these actions and breathe, too (Stafford, 2006; Canadian Pediatric Society (CPS), 2004).

At the age of six months, the infant is developmentally ready to accept solid foods and the weaning process can be initiated (CPS, 2004; Arvedson, 2006). As weaning refers to the addition of new foods not the mere cessation of breastfeeding, it requires that the baby develop the chew-swallow reflex that accompanies a certain degree of neurological development (Stafford, 2006; Highton, 2001). Eating table food is a new behavior for infants and toddlers (Bobbie, 2005). According to the National Resource Center for Health and Safety in Child Care (2002), learning to chew and swallow takes time. This

process of learning accompanies physical growth that is concurrent with social, cultural, sociological, and physiological development. This indicates the presence of critical and sensitive periods in the development of normal feeding behavior. Introducing complementary food to infants without considering these periods increases their vulnerability to choking hazards (Arvedson, 2006).

Choking is the interruption of respiration by internal obstruction of the airway, usually by food or small toys in young children (The European Child Safety Alliance, 2006; Kidsafe, 2006; Tarrago, 2000). This prevents oxygen from getting to the lungs and the brain leading to a brain damage or even death within four minutes (Norris and Smith, 2002). Children less than three years old are especially vulnerable to choking because they have small airways. They do not have a full set of teeth and cannot chew well as the older children, so large chunks of foods may lodge in the throat and cause choking. Furthermore, in infancy, the larynx is not only the narrowest part of the upper airway, but it is also relatively smaller than that in older children and adults, and this increases the risk of occlusion by a foreign body. Moreover, as part of the infant's development, the sucking pads in an infant's cheeks begin to disappear at the end of the first year (Highton, 2001). However, it may last for several years as

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witnessed by the use of bottles, dummies, and thumbs by many toddlers and preschoolers and it is shown to be the most common mouthing behavior at all ages (Norris and Smith, 2002). Children, especially younger ones, are at risk for choking as they have a tendency to place objects in their mouths and when they are learning to chew, they may attempt to suck or swallow foods whole (Bobbie 2005; Bren 2005). According to the 1997 U.S. Consumer Product Safety Commission annual study of children under age 9, one child chokes on food and dies in the United States every five days. The majority of victims are under age 5 (Stafford, 2006). Choking is a risk whenever food is consumed. A US study reports an incidence of death due to foreign body airway obstruction of 0.66 per 100,000 population (Mittleman and Wetli, 1982). Prevention of death from choking has long been a concern of health care providers, whose role may involve education of parents, other caregivers and manufacturers about the risks and the prevention of choking.

Infants' weaning and feeding processes and practices have been emphasized by several authors as a risk factor for choking (American Academy of pediatrics, 2001; Food Insight, 2002; Norris and Smith, 2002; Jafari *et al.*, 2003; Qureshi and Mink, 2003; Mikita and Callahan, 2006).

In Jordan, deaths from aspiration of foods and foreign material are not listed as a separate category. Furthermore, the relation between weaning and choking has not been highlighted on either a national level or worldwide. Therefore, this study aims to determine the epidemiological features of such deaths in one of the general teaching hospitals in Jordan with a focus on weaning practices and its relation to sucking as major factors underlying the mechanism of choking in infants and young children. The results can be used by health care managers in developing and implementing training programs for health care providers (pediatricians and nurses), emphasizing their role in providing health education to parents and other care givers on strategies directed at preventing choking and associated deaths.

2. Methodology

A total of 27 cases of choking in the pediatric age group were retrieved from the reports of the autopsy cases dissected at the forensic department at a general teaching hospital in Amman/ The Jordan University Hospital. The cases were analyzed and categorized according to their age, sex, nationality, history of exposure to foreign bodies, characteristics of obstructing bodies and the autopsy findings, especially the site of impaction and the stomach content. Confidentiality was maintained throughout the study.

3. Results

Table 1 shows that 16 (59.26%) of the diseased were males and 11 (40.74%) were females and the majority of the children (62.9%) were between 1 and 3 years of age. The second demographical factor is age. The age ranged between 7 months and 132 months with an average of 33.44 months age.

Table 1. Age group and male to female ratio

Age group (year)	N (%)	Male	female
< 1	6 (22.2)	4	2
1 - < 3	11 (40.7)	6	5
3 - < 5	4 (14.8)	2	2
5 - < 7	4 (14.8)	2	2
7 - < 9	1 (3.7)	1	0
11	1 (3.7)	1	0
Total	27 (100)	16	11

The witnessed cases were equal to the non-witnessed cases and three cases were not reported in table 2.

Table 2. The witnessed cases versus non-witnessed cases

History of exposure	Number of cases
Known, starts in the morning	2
Unknown, starts in the afternoon	7
Known, starts in the afternoon	6
Unknown, starts in the evening	5
Known, starts in the evening	4
Not reported	3

According to the time of death, 7 (25.9%) of the victims were dead on arrival, 10 (37.0%) sudden death, 7 (25.9%) within the way and 3 (11.1%) more than one day, as shown in table 3.

Table 3. Postmortem interval

Time of death	Number of cases (%)
Arrived dead	7 (25.9)
Immediate death	10 (37.0)
Within a day	7 (25.9)
More than one day	3 (11.1)

Food materials were the aspirated objects in 15 (55.6%) of the cases; non-food materials were in 12 (44.4%) cases. The obstructing food material in general is characterized by being solid, rounded or oval in shape, of moderate size and with smooth skinned surface. The choking non-food agents are mostly of rubber or plastic materials and with smooth surfaces as shown in table 4.

Table 4. Food material versus non-food material

Foreign body type	Number of cases (%)
Food materials	15 (55.6)
Non-food materials	12 (44.4)

Larynx 8 (37.0%) was the most common site of the foreign body. The foreign bodies were seen in the respiratory tract at trachea in 5 (25.9%), larynx and trachea in 5 (25.9%), bilateral main bronchi in 2 (7.4%), right main bronchi in 2 (7.4%), trachea at the level of vocal cords in 2 (7.4%), trachea and bronchi in 1 (11.1%), larynx and oropharynx in 1 (3.7%) and not reported case 1 (3.7%) in table 5.

Table 5. Number of cases according to obstructing site

Obstruction site	Number of cases (%)
Trachea	5 (25.9)
Larynx	8 (37.0)
Larynx & trachea	5 (25.9)
Trachea and bronchi	1 (11.1)
Right and left main bronchi	2 (7.4)
Right main bronchi	2 (7.4)
Trachea at the vocal cords	2 (2.7)
Larynx and oropharynx	1 (3.7)
Not reported	1 (3.7)

The stomach contained the same obstructing body in eight cases choked by food materials, as shown in table 6.

Table 6. Number of cases according to the stomach content

Stomach content	Number of cases
Not reported	8
irrelevant	2
Fluid contents	4
Semisolid contents	4
Food particles	6
Citrus fruit seed, milk	1
Some curdled milk	1
Pumpkin and water melon seeds	1

There was one death attributable to medical conditions, tracheoesophageal fistula which might have impaired swallowing and predisposed to aspiration of a foreign body. Another child was intubated and his death was due to brain hypoxia. In addition, 92.6% of these deaths occurred without a known medical history when they came to forensic department, see table 7.

Table 7. Number of cases according previous history of medical history

History medical illness	Number of cases
No Medical History	25
History of tracheoesophageal fistula	1
History of death due to brain hypoxia	1

4. Discussion

In the present study, a slight male pre-dominance have been reported (59.26%). The age of cases investigated by the present study ranged between 7 months and 11 years and the majority of the children were between 1 and 3 years of age. This age distribution goes in accord with that indicated by the American Academy of Pediatrics (Bruns and Thompson, 2010).

The academy reported that the children under three years of age are at a greater risk of choking and advised that once young children begin to eat table food educators and caregivers need to be aware of the dangers and risks of choking (Rimsza *et al.*, 2002). Fortunately, no case was reported to be less than 7 months which indicates that care

givers do not start to introduce food to their infants at this age.

According to the American Academy of Pediatric Dentistry (AAPD), early introduction (prior to 6 months of age) of solid food interferes with the intake of human milk or iron-fortified formula that the infant needs for growth. Weaning a child to drink from a cup is an individual process, which occurs over a wide range of time. However, the Academy recommends weaning by the child's first birthday (Bruns and Thompson, 2010; Bamber *et al.*, 2014).

Choking by food materials constituted the majority of the cases under 3 years of age while choking by non-food material were more prevalent above 3 years of age. **Studies reported that** children less than three years of age are especially vulnerable to choking because they have small airways. They do not have a full set of teeth and cannot chew well as the older children, so large chunks of foods may lodge in the throat and cause choking (Sidell *et al.*, 2013). Furthermore, in infancy, the larynx is not only the narrowest part of the upper airway, but it is also relatively smaller than that in older children and adults, and this increases the risk of occlusion by a foreign body (Collins, 1985). On the other hand, all of the non-food cases may be attributed to the lack of supervision and forceful suction in infants and young children, which becomes dangerous and even fatal whenever dangerous choking foods and non-food materials are present inside the mouth such as seeds, objects, latex balloons etc. (Rimell, 1995; Mallick, 2014). This also may be related to that choked infants and children were living in low socioeconomic and heavily populated areas in the capital city of Amman and outside Amman.

The time choking occurred was at midday or 13:00 in the afternoon in almost half of the cases (48.1%). During this period, the parents are usually busy and may leave the infant/child unattended with some food material in front of him/her or, in older children who find something to play with, such as balloons, away from supervision. Tarrago (2000) indicated that a poor parental supervision may be a contributing factor. Children need to be reminded to take small bites and chew thoroughly. Children are more likely to choke when fed by a sibling, as food may not be properly cut or inappropriate foods may be given to the younger child.

There is a limited number of studies reporting on the location of foreign body in fatal cases. In the present study, obstructions were in the larynx and larynx & trachea in sudden death cases, in the larynx in cases of rapid death. Similar findings were reported by Tomaskea *et al.* (2006); the problem is the forceful suction (suction can be considered as a form of an excessive sucking). This is supported by the cases of choking by non-food materials especially balloons; the mouth of the balloons were found to be at an upward direction (Abdel-Rahman, 2000). This indicates that balloons were sucked forcefully to be inverted in such a manner. The orientation of the whistle inside the larynx can be explained in the same way. Norris and Smith (2002) indicated that sucking was the most commonly observed mouthing behavior, accounting for approximately two thirds of all observed

mouthings behaviors of children between 1 month and 5 years.

The obstructing food material in general is characterized by being solid, rounded or oval in shape, of moderate size and with smooth skinned surface. The stomach contained the same obstructing body in the most of cases choked by food materials. Similar descriptions of the obstructing objects were given by Tarrago (2000). According to Bobbie (2005), children under 5 years often have a trouble in managing unfamiliar, irregular and hard foods. When infants and young children are learning to chew, they may attempt to swallow the whole food.

In the present study, one child had an underlying medical condition, tracheoesophageal fistula which might have impaired swallowing and predisposed to aspiration of a foreign body. Another child had a history of Cardiopulmonary resuscitation was done & patient intubated and his death was due to brain hypoxia.

The post-mortem intervals are summarized in Table 3, a prolonged survival interval was recorded in three cases; victims died within more than one day, seven cases were dead within a day and in the remaining cases death was reported to occur immediately after the choking incident.

In previous study, ten cases were identified out of a total autopsy population of 2165. Only one individual had an underlying diagnosis potentially contributing to aspiration. All but one case involved aspiration of food, with grapes being a feature of four cases. In cases with a prolonged survival interval, autopsy demonstrated bronchopneumonia and hypoxic-ischemic encephalopathy. In the remaining cases autopsy findings were non-specific (Bamber *et al.*, 2014).

In Turkey another study aimed to investigate the frequency and epidemiological features of deaths due to foreign body asphyxiation (FBA) in childhood, over 1990-2003. Of the victims, 14 (63.6%) were male and 8 (36.4%) females. There were 20 (90.9%) children between 1 and 3 years, and two other cases at 2/12 and 5 years of ages. All aspirations had occurred at home. Eight (36.4%) of the victims were dead on arrival, 11 (50%) on intervention, and 3 (13.6%) after complications. Food material was the most commonly aspirated foreign body in 81.8% of the cases, nuts being the most common (50%). Food asphyxiation remains a common problem particularly in children between 1 and 3 years of age in our region. (Goren *et al.*; 2005).

In conclusion, the study finding of age distribution goes in accord with that indicated by the American Academy of Pediatrics Health. Care personnel and parents need to be aware that introduction of solid food, unlike exclusive breast or formula -milk feeding, can have serious consequences if occurring in inappropriate timing or consistency during early childhood physical and functional development. In order to reduce the incidence of morbidity and mortality from choking, suffocation and strangulation, health care providers should provide anticipatory guidance to parents based on the developmental stage of the child. Health care managers need to ensure that health care providers are well equipped with the skills and knowledge necessary to carry out this role.

References

- Abdel-Rahman HA, 2000. Fatal suffocation by rubber balloons in children: mechanism and prevention. *Forensic Sci Int.*, **108(2)**:97-105.
- Arvedson J. 2006. Swallowing and feeding in infants and young children. GI Motility online doi: 10.1038/gimo17. Accessed; 7 Jan 2007.
- Bamber A, Pryce J, Ashworth M and Sebire N. 2014. Fatal aspiration of foreign bodies in infants and children. *Fetal Pediatric Pathol.*, **33(1)**:42-48.
- Bren L. 2005. Prevent Your Child From Choking. FDA Consumer magazine: September-October 2005 Issue. Available at: http://www.fda.gov/fdac/features/2005/505_choking.html. Accessed on 7 Jan 2007 02:06:42 GMT
- Bobbie R. 2005. Choking Can Be Prevented. *Child Care Health Connections*, **18 (4)**:4
- Bruns D. and Thompson S. 2010. Feeding challenges in young children. *Infants Young Children*, **23(2)**:93-102.
- Community Paediatrics Committee, Canadian Paediatric Society (CPS).2004. Weaning from the breast. Paediatrics and Child Health; 9(4), 249-253. Available at: <http://www.cps.ca/English/statements/CP/cp04-01.htm>. Accessed 18 Jan 2007 23:51:03 GMT
- Collins D. 1985. Childhood asphyxiation by food. *J Pediatric Surg.*, **20(1)**:96
- Goren S, Gurkan F, Tirasci Y, Kaya Z, Acar K.2005. Foreign body asphyxiation in children, *Indian Pediat*: [http://www.ncbi.nlm.nih.gov/pubmed/1634005342\(11\):1131-1133](http://www.ncbi.nlm.nih.gov/pubmed/1634005342(11):1131-1133).
- Highton B. 2001. Weaning as a Natural Process. *Leaven*, 36 (6); 112-114. Available at: <http://www.lalecheleague.org/llleaderweb/LV/LVDec00Jan01p112.html>. Accessed 28 Jan 2007 09:51:27 GMT
- Jafari S, Prince R, Kim D and Paydarfar D. 2003. Sensory regulation of swallowing and airway protection: a role for the internal superior laryngeal nerve in humans. *J Physiol.*, **550(1)**: 287-304
- Kidsafe QLD (INC). 2006. Choking and Suffocation. Available at: www.kidsafeqld.com.au. Accessed; August 2008
- Mallick M. 2014. Tracheobronchial foreign body aspiration in children: A continuing diagnostic challenge. *Afr J Paediatr Surg*, **11(3)**:225.
- Mikita C and Callahan C. 2006. Aspiration Syndromes. eMedicine Specialties - Pediatrics – Pulmonology. Available at: <http://www.emedicine.com/ped/topic2622.htm>. Accessed; August 2008
- Mittleman RE, Wetli CV. 1982. The fatal cafe coronary. Foreign-body airway obstruction. *JAMA.*, **247(9)**:1285-1288.
- National Resource Center for Health and Safety in Child Care. 2002. Caring for Our Children. 2nd ed. Available at: http://nrc.uchsc.edu/CFOC/HTMLVersion/Chapter_4.html. Accessed; Jan 2007
- Norris B and Smith S. 2002. The mouthing behavior of children up to 5 years old. Consumer and Competition Policy Directorate.
- Qureshi S and Mink R. 2003. Aspiration of fruit gel snacks. *Pediatrics*; **111 (3)**: 687-689.
- Rimsza M, Schackner R, Bowen K and Marshall W. 2002. Can child deaths be prevented? The Arizona Child Fatality Review Program Experience. *Pediatrics*, **110(1)**:e11-e11

Stafford L.2006. Don't Let Your Child Get All Choked Up. http://www.defenselink.mil/news/Nov1998/n11191998_9811196.html. Accessed; 17 Dec 2006 20:58:24 GMT

Sidell D, Kim I, Coker T, Moreno C and Shapiro N. 2013. Food choking hazards in children. *Inter J Pediatr Otorhinolaryngol.*, **77(12)**: 1940-1946.

Tarrago S. 2000. Prevention of choking, strangulation, and suffocation in childhood. *Wisconsin Medical J.*, **99(9)**:43-46)

The European Child Safety Alliance. 2006. Childhood Choking, Strangulation and Suffocation. Available at: <http://www.childsafetyeurope.org>. Accessed April 9, 2007

Tomaskea M, Gerberb A, Stockera S and Weiss M. 2006. Tracheobronchial foreign body aspiration in children – diagnostic value of symptoms and signs. *Swiss Med Wkly*; **13**