

Laura Dolkas,¹ M.D.; Christina Stanley,² M.D.; Alan M. Smith,³ Ph.D.; and Gary M. Vilke,^{1,3} M.D.

Deaths Associated with Choking in San Diego County

ABSTRACT: Death from choking is the fourth most common cause of unintentional-injury mortality, but little data are published on causes or locations of these episodes. These deaths typically are peaked at the extremes of age, with young children and the elderly having the greatest rate of fatal choking. Our objective was to characterize the causes of fatal airway obstruction in adults. The San Diego County Medical Examiner's database was searched for deaths attributed to choking in decedents 18 years and older during the 10-year period from 1994 to 2004. Data were abstracted regarding the underlying medical conditions, items choked on, location of the choking, and treatments involved in the individual cases. We found 133 victims who died from choking, with 14% having used alcohol or other sedatives and 55% having a documented neurological deficit or anatomic difficulty with swallowing. The most common specified food objects that victims choked on were meat products, and 45% occurred at home, followed by 26% at supervised facilities, and 14% at restaurants. Of the 19 choking episodes occurring in restaurants, only one employee was documented to attempt a resuscitative effort. Most victims who choked to death had an underlying neurological deficit, and occurred at home or supervised facilities appear to have an appropriate initial-response intervention.

KEYWORDS: forensic science, choking, obstruction, airway, foreign body

Death due to choking is defined as unintentional ingestion or inhalation of food or other objects resulting in the obstruction of respiration (1). In the United States, *c.* 4300 fatal episodes of choking occurred in 2003, making this the fourth most common cause of unintentional-injury mortality (1). Of these fatal episodes due to choking, the highest risk groups are the elderly and children younger than four years (1). Considerable literature exists characterizing foreign body aspiration in children (2–6), but not among adults. Although treatment of airway obstruction in adult patients who are admitted to the hospital has been studied extensively in the literature (7–11), little data on the various causes, possible predisposing factors (12,13), and demographics of adult airway obstruction are available. Given that the signs and symptoms of foreign body aspiration are often nonspecific (7), it is important for first responders and caregivers, such as Skilled Nursing Facility nurses, to recognize the risk factors and signs of adult airway obstruction and to be able to treat it in the pre-hospital setting.

Materials and Methods

The San Diego County Medical Examiner database was queried for patients aged 18 years and older with a death attributed to choking from food or other objects for the period from January 1, 1994, through December 31, 2004. Information extracted from each investigative record included age in years, predisposing factors, and significant comorbidities (dysphagia, neurological disorders, esophageal dysmotility, mental retardation, alcohol or sedative use, and poor dentition). In addition, the location of the choking

episode and the identity of the foreign body were obtained. Attempts at therapeutic intervention were also extracted from the database. No patient-identifying information was collected from the records. Descriptive analysis was conducted using the SPSS version 12.0 statistics package. The University of California, San Diego Investigational Review Board approved this study.

Results

There were 133 victims who choked to death with a median age of 73 years. The gender distribution was 46% female. Ages ranged from 22 to 97 years, with the distribution depicted in Fig. 1. Fourteen percent of the victims were documented to be under the influence of alcohol or other sedatives. Approximately 55% of the victims had a documented neurological deficit or anatomic difficulty with swallowing, including, but not limited to, one or more of the following: dysphagia, cerebrovascular accident, multiple sclerosis, seizure disorder, mental retardation, dementia, esophageal dysmotility, laryngeal cancer, cerebral palsy, neurological tumors, and other organic brain syndromes. Table 1 presents a

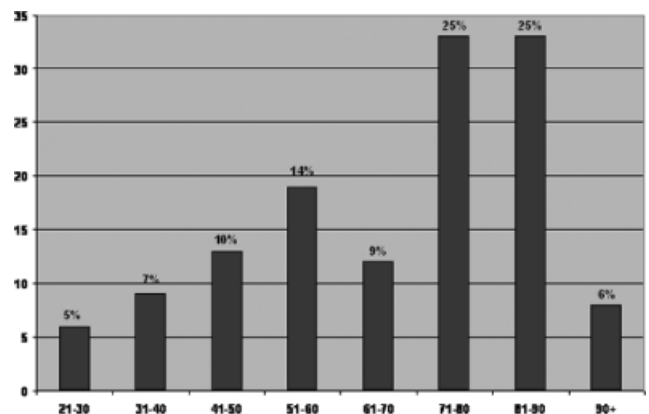


FIG. 1—Age distribution of subjects who died of choking.

¹Department of Emergency Medicine, San Diego Medical Center, University of California, 200 West Arbor Drive, San Diego, CA 92103.

²Office of the Medical Examiner, County of San Diego Health and Human Services, 5555 Overland Avenue, Suite 1411, San Diego, CA 92123-1245.

³San Diego County Division of Emergency Medical Services, 6255 Mission Gorge Road, San Diego, CA 92120.

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TABLE 1—List of medical conditions reported in the subjects who died of choking.

Hypertension	31
Diabetes mellitus	28
Dementia	22
Cerebrovascular disease	20
Schizophrenia ± affective	16
Coronary artery disease	14
Depression	13
Alcoholism	12
Arrhythmia	12
Chronic obstructive pulmonary disease	12
Mental retardation	12
Parkinsonism	12
Congestive heart failure	10
Dysphagia or dysmotility	10
Seizure disorder	10
Atrial fibrillation	9
Hypothyroid	8
History of choking/aspiration	6
Myocardial infarction	6
Bipolar	5
End-stage renal disease	5
Substance abuse	5
Cerebrovascular disease	5
Cirrhosis	4
Paralysis	4
Lung cancer	4
Psychosis	4
Asthma	3
Cerebral palsy	3
Breast cancer	3
Obesity	3
Multiple sclerosis	3
Prostate cancer	3
Organic brain syndrome	3
Transient ischemic attack	3
GI bleed	3
Cardiomyopathy	2
Tremors	2
B12 deficiency	2
Venous thromboembolism	2
Benign prostatic hypertrophy	2
Ataxia	2
Anxiety	2
Incontinence	2
Scoliosis	2
Laryngeal cancer	2
Glaucoma	2
HCV	2
Tuberculosis	2
Mute	2
Gastroesophageal reflux	2
Goiter	1
Cardiomegaly	1
Atherosclerosis	1
Metabolic encephalopathy	1
Asbestosis	1
Cervical-herniated disks	1
Closed head injury	1
Syphilis	1
Esophageal dysmotility	1
Colon cancer	1
Meningioma	1
Hearing loss	1
Hemiplegia	1
Coagulopathy	1
Throat trauma	1
Tongue dissection	1
Mallory-Weiss tear	1
Dysarthria	1
Cleft palate	1
Poor dentition	1
Adrenal insufficiency	1
Cataracts	1
Hepatitis	1

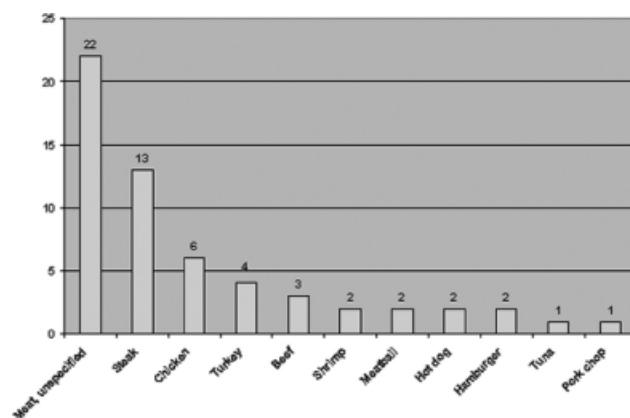


FIG. 2—Distribution of the types of meat on which the subjects choked.

complete list of the victims' medical diagnoses, which includes the neurological deficits, anatomic difficulty with swallowing, and other unrelated medical conditions.

The most common foreign body reported was unspecified food (20%). The most common specified food objects that victims choked on were undetermined meat products (17%), and of those characterized, steak (10%) and chicken (5%) were the most highly represented. The breakdown of meat products is displayed in Fig. 2. The next most common food object was a peanut butter and jelly sandwich (4%), with all other food items representing less than 2%. Table 2 lists the detailed food items described in the investigative summaries. Nonfood objects were implicated in 6% of cases and included unspecified vomitus (3), dentures (2), broken teeth (1), latex glove (1), and a plastic bag filled with narcotics (1).

The majority of the choking episodes occurred at home (45%), followed by supervised facilities (26%), restaurants (14%), hospitals (3%), the street (3%), hotels (2%), schools (2%), other (3%), and unknown locations (2%). These are shown in Fig. 3. Supervised facilities included skilled nursing facilities, board, and care homes, assisted living facilities, and convalescent hospitals. First-response interventions included a combination of finger sweeps, the Heimlich maneuver, CPR, and more sophisticated techniques once paramedics were summoned. Figure 4 depicts the initial interventions performed by paramedics (40%), both family and paramedics (21%), staff at supervised homes (17%), bystanders (8%), or no one (14%). Of the 19 choking episodes occurring in restaurants, only one employee was documented to attempt an initial-response resuscitative effort, and almost half of these cases involved the paramedics as the only initial intervention.

Discussion

Most victims who choked to death were older and had an underlying neurological deficit or anatomic difficulty with swallowing. Meat was by far the most common food item that victims choked on; thus, it may serve as a potential item for caregivers to pay particular attention to when preparing meals for the elderly and patients with predisposing factors for choking. Victims choking at home appear to have an appropriate first-response intervention as family members and friends performed resuscitative procedures with the aid of 9-1-1 operators, and they were quickly relieved by paramedics in most cases. Staff members in supervised facilities were similarly quick to initiate resuscitative efforts. However, those who choke to death in restaurants appear to lack immediate intervention from restaurant personnel, family,

TABLE 2—List of food items on which subjects choked.

Food, unspecified	26
Meat, unspecified	22
Steak	13
Nonfood objects	8
Chicken	6
Peanut butter jelly sandwich	5
Turkey	4
Carrots	3
Pancakes	3
Broccoli	2
Burrito	2
Hot dog	2
Meatball	2
Pizza	2
Toast	2
Hamburger	2
Shrimp	2
Apple	1
Bagel	1
Beef ribs	1
Beef	1
Biscuit dough	1
Brussel sprout	1
Calzone	1
Cherry tomato	1
Chicken soup	1
Cinnamon roll	1
Corned beef	1
Cupcake	1
Egg salad	1
Egg sandwich	1
Cantaloupe	1
Ham sandwich	1
Lasagna	1
Muffin	1
Pineapple	1
Pork chops	1
Prunes	1
Pureed food	1
Rice ball	1
Sandwich	1
Spam sandwich	1
Strawberries	1
Tuna	1

or bystanders in almost half of the cases studied. Restaurant patrons were more likely to receive aid from family members or bystanders than from restaurant employees or managers at the scene. This suggests that restaurant patrons, particularly ones dining at steak houses or other establishments serving meat products,

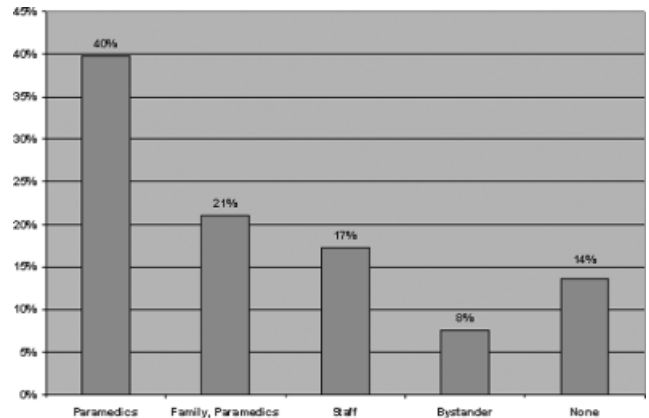


FIG. 4—Distribution of who offered the first medical intervention to the subject during the choking episode.

could benefit from employees trained in basic CPR and the Heimlich maneuver.

Our study had findings similar to those noted by Mittleman and Wetli (13), where they noted that old age, poor dentition, sedative drugs, and natural diseases, particularly Parkinson's disease, were frequent predisposing factors for foreign body airway obstruction, also known as the "café coronary." Berzlanovich et al. (14) noted that food or foreign body aspiration in the elderly was characterized by a significantly higher asphyxiation on soft or slick foods. This was contrasted by the younger individuals, who choked more often on large pieces of foreign material and showed a higher rate of blood alcohol concentration. In another study, Berzlanovich et al. noted that in 63% of the cases of adult choking, EMS was called. However, in 92% of the cases, neither the observers nor the majority of the EMS personnel and physicians who would have been able to intervene recognized the definite diagnosis. Only 10 of 120 cases were correctly identified during cardiopulmonary resuscitation (15). Irwin et al. (12) noted that 1.3% of all deaths of patients who came to autopsy at a hospital for chronic diseases were caused by food asphyxiation. Acute myocardial infarction was mistakenly diagnosed in eight of 14 patients until diagnosed at autopsy.

This study was limited by its design as a retrospective review of an existing database. Investigative summaries did not always comment on whether sedatives were involved, so 86% of the victims were either not intoxicated or were under the influence of a sedative without documentation of such information. Similarly, the past medical histories were only as complete as the medical examiner investigators were able to obtain from hospital records and family members. Undiagnosed medical conditions that may have predisposed patients to choking were not documented and thus not included in this study. The identity of food items and types of food establishments were also not available in many cases.

Conclusions

Most victims who choked to death had an underlying neurological deficit and choked on meat. Victims choking at home or supervised facilities appear to have an appropriate initial-response intervention; however, those who choke to death in restaurants appear to lack immediate intervention. Restaurant patrons could benefit from employees trained in basic CPR.

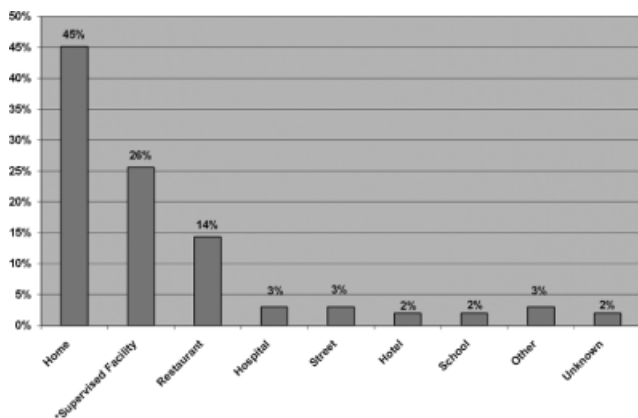


FIG. 3—Location of the subject at the time of the choking episode.

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Additional information and reprint requests:

Gary M. Vilke, M.D.
 Department of Emergency Medicine
 UC San Diego Medical Center
 200 West Arbor Drive Mailcode #8676
 San Diego, CA 92103
 E-mail: gmvilke@ucsd.edu