International Journal of Computational and Experimental Science and ENgineering (IJCESEN)

Vol. 11-No.4 (2025) pp. 7324-7334
http://www.ijcesen.com

ISSN: 2149-9144

Research Article

Choking First Aid Techniques for Adults and Children by Red Crescent

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Article Info:

DOI: 10.22399/ijcesen.4009
Received : 01 January 2025
Accepted : 28 January 2025

Keywords

Choking,
Foreign Body Airway Obstruction (FBAO),
First Aid,
Heimlich Maneuver,
Abdominal Thrusts,
Pediatric Choking,

Abstract:

Choking is a critical emergency that requires immediate action, as it can obstruct airflow and lead to severe consequences within minutes. For adults, the first response is often the Heimlich maneuver, which involves standing behind the individual and wrapping your arms around their waist. The rescuer should make a fist with one hand and place the thumb side against the middle of the person's abdomen, above the navel. A quick, inward and upward thrust can help expel the object blocking the airway. If the person becomes unconscious, it's essential to call emergency services and initiate CPR, alternating between chest compressions and rescue breaths to maintain circulation and oxygen flow. When dealing with choking in children, techniques vary slightly based on age. For infants under one year, the recommended approach is a series of five back blows, delivered between the shoulder blades using the heel of the hand, followed by five chest thrusts using two fingers on the lower half of the sternum. For children aged one year and older, the Heimlich maneuver can be adapted similarly to adults, though the rescuer should be mindful of using less force appropriate to the child's size. Regardless of age, it is crucial to remain calm and encourage the child to cough forcefully if they can, as this may help dislodge the object on their own. In all cases, seeking professional medical assistance afterward is advisable, even if the object seems to be expelled.

1. Introduction

Choking is a sudden, terrifying, and life-threatening medical emergency that occurs when a foreign object, most commonly a piece of food, becomes lodged in the airway, obstructing the flow of air to the lungs [1]. The human body's immediate response to this obstruction is a cascade of physiological alarms: the inability to speak, cough, or breathe, leading to hypoxia, loss of consciousness, and, if the obstruction is not relieved, cardiac arrest and death within a matter of minutes. The universal sign of choking—clutching the throat with one or both hands—is a silent plea for help that can strike anyone, anywhere, at any time, turning an ordinary meal or moment of play into a critical situation [2].

The epidemiology of choking incidents underscores the critical importance of widespread public knowledge of first aid responses. Globally, choking is a leading cause of morbidity and mortality, particularly in two vulnerable demographics: young children and the elderly [3]. In children under the age of five, their natural curiosity, a tendency to explore the world with their mouths, underdeveloped swallowing coordination, and small airway diameter make them exceptionally susceptible. Common culprits include hot dogs, grapes, nuts, hard candies, coins, and small toy parts [4]. For adults, especially the elderly, risk factors include denture use, difficulty swallowing (dysphagia) often associated with neurological conditions like stroke or Parkinson's disease, and the consumption of alcohol impairing the swallowing reflex [5]. The setting of these incidents is most frequently the home, a fact that highlights the necessity for first aid training not only among healthcare professionals but also within families and the general public [6].

The physiological basis for choking first aid lies in the anatomy of the airway and the mechanics of respiration. The airway is divided into the upper airway (pharynx and larynx) and the lower airway (trachea and bronchi). A foreign body can cause a partial or complete obstruction. A partial obstruction may allow for some air exchange; the victim might be able to cough, albeit weakly, or wheeze. In this "mild" choking scenario, the body's own cough reflex is the most effective and safest mechanism to clear the airway, and first aid intervention should be limited to encouraging the victim to cough while monitoring their condition closely [7]. However, a complete obstruction is a true emergency. With no air able to pass the blockage, the victim cannot speak, cough, or breathe. Oxygen levels in the blood (SpO2) plummet rapidly, leading to cerebral hypoxia. The brain can sustain irreversible damage after only four to six minutes without oxygen, making immediate intervention not just recommended but imperative for survival [8].

The cornerstone of modern choking first aid for a conscious victim with a complete airway obstruction is the Heimlich maneuver, also known as abdominal thrusts. Developed by Dr. Henry Heimlich in 1974, this technique operates on a simple yet powerful physical principle: by applying sudden, upward pressure beneath the diaphragm, the maneuver compresses the lungs and exerts a forceful burst of air from the residual volume in the lower airways [9]. This artificially generated "cough" travels up the trachea with sufficient pressure to eject the lodged object. The American Heart Association (AHA), the American Red Cross, and the European Resuscitation Council (ERC) all endorse abdominal thrusts as the standard of care for a conscious choking adult or child over one year of age [10, 11].

However, a one-size-fits-all approach is medically unsound and potentially dangerous. This is most evident in the distinct protocols for infants (children under one year of age). Their small size, fragile internal organs, particularly the liver, and developmental stage necessitate a completely different technique. For infants, the recommended first aid sequence involves a combination of back blows and chest thrusts, deliberately avoiding abdominal thrusts due to the high risk of intra-abdominal injury [12]. This critical distinction underscores the necessity for tailored first aid education that clearly differentiates between infant, child, and adult protocols.

Furthermore, the scenario becomes significantly more complex when the choking victim becomes unconscious. At this point, the procedure transitions from a standalone first aid maneuver to a integrated cardiopulmonary resuscitation (CPR) protocol. The guidelines from organizations like the AHA and ERC stipulate that once a choking victim loses consciousness, the rescuer should carefully lower them to the ground, immediately activate emergency medical services (if not already done), and begin cycles of chest compressions and rescue breaths [13]. The chest compressions in an unconscious victim serve a dual purpose: they circulate blood to the vital organs and, by compressing the thorax, may generate enough pressure to dislodge the foreign body, much like a chest thrust. Each time the airway is opened to attempt a rescue breath, the rescuer should visually check the mouth for the object, removing it only if it is clearly visible.

This research paper will delve deeply into these life-saving techniques, structuring the discussion to

provide a clear, actionable guide for potential rescuers. The subsequent sections will be organized to first detail the step-by-step procedures for conscious adults and children, followed by the specific protocol for infants. It will then explore the management of the unconscious choking victim, integrating the principles of Basic Life Support (BLS). Finally, the paper will address common complications associated with these techniques, the importance of post-event medical evaluation, and the overarching need for widespread, standardized public education to empower bystanders to act decisively and correctly in the face of this acute emergency. By synthesizing the latest guidelines and scientific rationale, this paper aims to be a comprehensive resource for understanding and applying choking first aid, ultimately contributing to improved survival outcomes from this sudden and critical event.

2. Anatomical and Physiological Basis of Airway Obstruction

The upper airway begins with the oral cavity, leading posteriorly to the oropharynx and laryngopharynx. The larynx, or voice box, serves as the guardian of the lower airway, with the epiglottis acting as a pivotal flap that covers the entrance to the larynx during swallowing. Below the larynx lies the trachea, a semi-rigid tube held open by C-shaped cartilaginous rings, which bifurcates at the carina into the right and left main bronchi [14]. This point of bifurcation is of particular clinical significance. Due to the wider diameter and more vertical orientation of the right main bronchus compared to the left, inhaled foreign bodies are more frequently lodged in the right bronchial tree [15]. In children, the anatomy presents unique vulnerabilities; their airways are not only smaller in diameter but also softer and more compliant. The narrowest point in a child's upper airway is the cricoid cartilage, a complete ring located below the vocal cords, as opposed to the vocal cords themselves in adults. This anatomical distinction means that an object passing through the glottis in a child can still become tightly lodged at the level of the cricoid ring, creating a "full-house" obstruction that is exceptionally challenging to clear [16].The physiology of airway protection is a marvel of neural coordination. Swallowing is typically divided into three phases: oral, pharyngeal, and esophageal. The critical pharyngeal phase is an involuntary reflex initiated when the bolus of food touches the posterior pharyngeal wall. This triggers a rapid sequence: the soft palate elevates to seal off the nasopharynx, the larynx elevates, the vocal cords adduct (close), and the epiglottis folds down to direct the food bolus over and around the closed laryngeal inlet and into the esophagus [17]. Respiration momentarily ceases during this pharyngeal phase—a phenomenon known as deglutition apnea—to ensure the airway is protected. Choking occurs when this finely tuned sequence is disrupted. Common causes include a large or poorly chewed food bolus, attempting to talk or laugh while swallowing (which can prematurely open the vocal cords), or impaired neuromuscular coordination due to neurological disorders, alcohol, or sedative drugs [18].When a foreign body bypasses these protective mechanisms, the nature and severity of the obstruction are paramount. A partial airway obstruction can be classified as "good" or "poor" based on air exchange. With good air exchange, the victim can still generate a strong, effective cough and speak. The body's own defense mechanisms are functioning, and the goal of first aid is to encourage coughing without intervening physically [19]. A poor air exchange partial obstruction, characterized by a weak, ineffective cough, high-pitched stridor (an inspiratory sound indicating turbulence at the laryngeal level), and increasing cyanosis (bluish discoloration of the skin), is a prelude to a complete obstruction and requires immediate intervention. A complete obstruction, as the name implies, allows no air to pass. The victim cannot speak, breathe, or cough. The inability to speak is a critical diagnostic sign, as it indicates the object is lodged at the level of the larynx, completely occluding the glottic opening [20].The physiological consequences of a complete airway obstruction are rapid and devastating. The initial response is often a combination of sheer panic and the body's violent, but futile, attempts to clear the obstruction. As breathing ceases, oxygen levels in the arterial blood (PaO_2) plummet, leading to hypoxia. The brain is the organ most sensitive to hypoxia; consciousness is typically lost within 60 to 120 seconds in a fully obstructed adult [21]. Concurrently, carbon dioxide (CO_2) levels rise (hypercapnia), leading to respiratory acidosis. This state of asphyxia triggers a massive sympathetic nervous system discharge, causing tachycardia and hypertension initially. However, without intervention, bradycardia and hypotension soon follow as severe hypoxia damages the myocardial tissue and the brain's regulatory centers. Cardiac arrest from pulseless electrical activity (PEA) typically follows within 4 to 6 minutes in adults, and even more rapidly in children, due to their higher metabolic rate and lower oxygen reserves [22].The physical principles behind first aid techniques are directly designed to reverse this pathophysiology. The Heimlich maneuver (abdominal thrusts) works by forcibly

elevating the diaphragm. The diaphragm is the primary muscle of inspiration, and its upward displacement compresses the lungs, increasing intrathoracic pressure. The air trapped in the "thoracic reservoir," specifically the residual volume of air remaining in the lungs after a normal exhalation, is expelled rapidly up the trachea. This artificially generated burst of air, traveling at a significant velocity, acts as a piston to dislodge the obstructing object [23]. Similarly, chest thrusts and the chest compressions used in CPR for an unconscious victim operate on the same principle of increasing intrathoracic pressure to create an artificial cough. For infants, back blows are designed to create vibrations and pressure changes in the airway through percussive force, while chest thrusts use the same intrathoracic compression mechanism as in adults but are applied more safely to the infant's sternum, avoiding the fragile abdomen. Thus, every recommended first aid procedure is grounded in a deep understanding of thoracic biomechanics and the urgent need to replicate the body's lost ability to generate expulsive force.

3. Classification of Choking Situations:

The home environment is, statistically, the most common location for choking incidents across all age groups, but it is particularly lethal for young children and the elderly. For children under five, the home is a landscape of exploration and potential danger. Their natural oral exploratory behavior, coupled with underdeveloped chewing and swallowing abilities, a smaller airway diameter, and a tendency to be active or distracted while eating (e.g., running, playing, or laughing), creates a perfect storm for choking [24]. The most frequent culprits are round, cylindrical, or compressible foods that can perfectly occlude a child's airway. These include hot dogs, whole grapes, nuts, popcorn, hard candies, and chunks of raw carrots or apple [25]. Non-food items are equally dangerous, with coins, button batteries, small toy parts (like Lego pieces), and balloons being leading causes of fatal childhood choking [26]. For the elderly, home-based choking risks are often related to age-related physiological changes and comorbidities. Denture use can impair sensory feedback and chewing efficiency, while neurological conditions such as stroke, dementia, or Parkinson's disease can cause dysphagia (difficulty swallowing) [27]. Furthermore, the use of sedative medications or simply eating alone increases the risk, as there may be no one present to intervene should choking occur.In contrast to the domestic setting, choking incidents in the workplace are often related to non-food items and specific occupational hazards. While food-related choking can certainly occur in break rooms, many workplaces present unique risks not found in the home. The National Institute for Occupational Safety and Health (NIOSH) has documented cases of choking on a variety of objects held in the mouth by workers during manual tasks. These include nails, screws, tacks, and pins among construction workers and carpenters, who often hold these items for convenience [28]. Similarly, artists, seamstresses, and office workers may hold pins or pushpins in their lips. The act of talking, laughing, or being startled can lead to the inadvertent inhalation of these objects. In industrial settings, exposure to dust, fumes, or chemicals can trigger a sudden coughing spell while a worker is eating or drinking, potentially leading to aspiration [29]. Another significant, though often overlooked, workplace risk is among healthcare providers, particularly those caring for individuals with developmental disabilities or neurological impairments, who may be at risk of being bitten or may need to manage a patient's choking episode, requiring specialized training that goes beyond standard first aid [30].Public settings present a distinct set of challenges for both the prevention and management of choking events. Restaurants are a high-incidence location for adult choking, primarily due to the social nature of dining. The combination of alcohol consumption, which impairs swallowing coordination and judgment, large portions of poorly chewed meat (especially steak), and the distractions of conversation and laughter significantly elevates the risk [31]. The public nature of these events, however, means that there is a higher likelihood of bystanders being present, but it also introduces the psychological barrier of the "bystander effect," where individuals may hesitate to intervene, assuming someone else is more qualified [32]. Schools and daycare centers are another critical public setting. While staff are often trained in pediatric first aid, the presence of large groups of children eating simultaneously, coupled with the propensity for children to share or swap food, creates a constant risk. Stringent policies against high-risk foods and mandatory teacher training in child CPR and choking first aid are essential preventative measures in these environments [33]. Finally, other public spaces like sporting events, airplanes, and movie theaters pose risks due to the consumption of snacks like peanuts and popcorn in often dimly lit, crowded, or noisy environments where an individual's distress might not be immediately noticed.The implications of this environmental classification are profound for public health strategy and first aid training. Prevention in

the home requires targeted parental education on food preparation for young children (e.g., cutting grapes lengthwise and hot dogs into non-cylindrical pieces) and keeping small objects out of reach, combined with encouraging the elderly with known dysphagia to eat slowly and in an upright posture, with moistened foods if necessary [34].

4. Adult Choking: Recognizing and Responding to Partial vs. Complete Obstruction

The initial assessment of a choking adult begins with rapid observation. If the victim is coughing or speaking, this is the most reliable indicator that the airway is only partially obstructed. In a partial obstruction with good air exchange, the victim will be able to produce a strong, effective cough, may be able to speak in full sentences, and might be wheezing or gasping between coughs. The universal sign of choking—clutching the neck with one or both hands (the "clutching the throat" sign)—may or may not be present [35]. In this scenario, the body's own reflexes are actively working to expel the object. The role of the rescuer is solely to act as a coach and monitor. The rescuer should calmly encourage the victim to continue coughing, should not interfere with their attempts, and must remain prepared to act immediately if the victim's condition deteriorates from good air exchange to poor air exchange or complete obstruction [36]. Intervening with back blows or abdominal thrusts on a person with a strong cough could potentially cause the object to dislodge and then re-lodge in a position that causes a complete obstruction.A partial obstruction with poor air exchange is a precarious and deteriorating state that signals the imminent threat of a complete blockage. The signs are markedly different from those of good air exchange. The victim's cough will become weak, ineffective, and silent. They may exhibit stridor, a high-pitched, musical sound heard during inspiration, indicating turbulent air flow through a severely narrowed airway at the level of the larynx [37]. The victim's ability to speak will be reduced to faint whispers or may disappear entirely. As hypoxia begins to set in, cyanosis (a bluish tint to the lips, nail beds, and skin) may appear, and the victim may become increasingly agitated or confused. At this point, the obstruction is life-threatening, and the body's own mechanisms are failing. Immediate action is required, and the rescuer must transition to the same protocol used for a complete obstruction without delay [38].A complete airway obstruction is a dire emergency characterized by the absence of air movement. The victim will be unable to speak, cough, or breathe. They may silently clutch their throat with one or both hands, a universally recognized distress signal. As the brain is deprived of oxygen, the victim may initially appear panicked and then will rapidly develop cyanosis and, typically within one to two minutes, lose consciousness [39]. For a conscious adult with a complete airway obstruction, the American Heart Association (AHA) and other international bodies mandate the immediate application of the Heimlich maneuver, or abdominal thrusts. The rescuer should stand behind the victim, wrap their arms around the victim's waist, and make a fist with one hand, placing the thumb side against the victim's abdomen, in the midline, just above the navel and well below the xiphoid process [40]. The other hand grasps the fist, and quick, inward and upward thrusts are delivered. Each thrust should be a separate, distinct attempt to dislodge the object, with the goal of generating an artificial cough. This sequence should be continued until the object is expelled or the victim becomes unconscious.The management of the choking victim who becomes unconscious represents a critical transition in the rescue protocol. The rescuer must carefully lower the victim to the ground, immediately activate the emergency response system (call for an ambulance/EMS), and begin cardiopulmonary resuscitation (CPR). However, the CPR sequence for a choking victim is specifically modified. Instead of beginning with compressions, the rescuer should start each cycle of CPR with a check of the mouth [41]. After opening the airway using a head-tilt/chin-lift maneuver, the rescuer should look inside the mouth for any visible object. If an object is seen, a single finger sweep should be used to remove it; blind finger sweeps are avoided as they may push the object deeper into the airway. Following this check, the rescuer should attempt to give two rescue breaths. If the breaths do not make the chest rise (indicating the obstruction is still present), the rescuer then proceeds to 30 chest compressions [42]. The compressions in this context serve a dual purpose: they circulate some oxygenated blood and, by compressing the thorax, can act like a chest thrust to dislodge the object. This cycle of check-mouth, attempt breaths, and 30 compressions is repeated until the obstruction is cleared, advanced help takes over, or the victim begins to breathe normally.Special consideration must be given to victims who are late-stage pregnant or visibly obese. In these individuals, the standard abdominal thrusts may be ineffective or could cause internal injury due to the enlarged abdomen or large girth. The recommended technique is to perform chest thrusts instead. The hand placement for chest thrusts is the same as for chest compressions in CPR: the heel of the hand is

placed on the center of the chest, on the lower half of the sternum [43]. For a conscious standing victim, the rescuer stands behind the victim, places their arms directly under the victim's armpits to encircle the chest, and delivers backward thrusts. If the victim is unconscious, chest thrusts are performed as part of the modified CPR protocol described above, using the standard chest compression landmark. Furthermore, for a victim found alone, self-administered abdominal thrusts are possible by using one's own fist and thrusting inward and upward against the abdomen, or by leaning forcefully over a firm object such as the back of a chair, a railing, or a kitchen counter [44]. This self-help technique empowers individuals to act even when no bystander is available, potentially bridging the critical gap until help arrives.

5. Pediatric Choking: Age-Specific Considerations and Warning Signs

The infant (under 1 year old) is uniquely susceptible to choking due to a confluence of anatomical and developmental factors. Their airways are exceptionally small in diameter; a mere 4mm obstruction, such as that caused by a small grape or a button battery, can cause a complete blockage [45]. Furthermore, the infant's larynx is positioned higher in the neck, and the primary narrow point is the cricoid cartilage, a complete, non-distensible ring, unlike the vocal cords in adults. This means an object that passes through the vocal cords can become tightly lodged lower down, creating a severe obstruction [46]. Physiologically, infants have an immature swallowing coordination and a strong, innate suck reflex, but they lack the molars necessary for proper grinding of food. Their primary sources of nutrition—liquid milk—generally pose a low risk, but the introduction of solid foods and their innate curiosity for putting any object in their mouth introduces extreme hazard. Common choking hazards for infants include small toys, coins, button batteries (which also cause chemical burns), marbles, and inappropriate solid foods like nuts, raw vegetables, or whole grapes [47].The first aid response for a choking infant is deliberately and fundamentally different from that for an older child or adult. Abdominal thrusts (the Heimlich maneuver) are strictly contraindicated in infants due to the high risk of causing severe internal injuries, including damage to the liver, spleen, or other abdominal organs [48]. The approved technique for a conscious, choking infant is a sequence of back blows followed by chest thrusts. The infant should be placed face down, straddling the rescuer's forearm, with the head lower than the chest and firmly supported. The rescuer delivers five firm back blows between the infant's shoulder blades using the heel of the hand [49]. If the object is not expelled, the infant is then turned face-up, still positioned with the head lower than the body, and five chest thrusts are administered. Chest thrusts are performed similarly to CPR compressions: using two fingers placed on the center of the chest, just below the nipple line (on the lower third of the sternum), the rescuer compresses the chest about 1.5 inches deep [50]. This sequence of five back blows and five chest thrusts is repeated until the object is dislodged or the infant becomes unconscious. The mechanics of this technique use gravity (from the head-down position) and percussive force to dislodge the object, while chest thrusts generate an artificial cough by increasing intrathoracic pressure, mimicking the physiology of abdominal thrusts in a safer manner for the infant's body.As a child progresses into the toddler years (1-3 years), the risk profile evolves but remains critically high. This period is marked by increased mobility, boundless curiosity, and a strong oral exploratory drive. While they are developing molars and better swallowing coordination, toddlers are often distracted, active, and prone to running or playing with food in their mouths. They also engage (imitation), potentially putting non-food items in their mouths because they see others doing so. The most common choking hazards for this age group are foods that are round, firm, or slippery: whole hot dogs, whole grapes, hard candy, nuts, popcorn, and chunks of meat or cheese [51]. Non-food items remain a severe threat, including balloons (the leading cause of choking death from non-food items), small balls, toy parts, and coins [52]. For a conscious choking toddler, the response transitions to techniques used for older children and adults, namely abdominal thrusts. However, the rescuer must kneel or position themselves behind the child to be at the appropriate height, and the force of the thrusts must be moderated to the child's smaller size. The landmark for hand placement remains the same: in the midline, just above the navel and well below the sternum.Recognizing the warning signs of choking in a pediatric patient is paramount, as infants and young children cannot verbalize their distress. The classic universal choking sign—clutching the throat—may be absent, especially in infants. The signs can be categorized based on the severity of the obstruction. For a partial obstruction with good air exchange, the child may be coughing forcefully, might be crying or able to speak (if verbal), and may have wheezing sounds [53]. In this scenario, the rescuer should not physically intervene but must stay with the child, encourage coughing, and be prepared to act if the situation worsens. The signs

of a severe or complete obstruction are silent and terrifying. The child will be unable to cough, cry, or make any sound. There may be silent, frantic struggling, and the child may appear panicked. As hypoxia sets in, the child's skin, particularly around the lips and nail beds, may turn a bluish color (cyanosis), and they may rapidly lose consciousness [54]. Any child who is found to be suddenly unable to vocalize, coupled with difficulty breathing, should be immediately assumed to have a complete airway obstruction, and the appropriate first aid protocol must be initiated without delay.For the unconscious choking infant or child, the response protocol integrates with pediatric cardiopulmonary resuscitation (CPR). After verifying unresponsiveness, the rescuer should shout for help, activate emergency medical services, and begin CPR. However, as with adults, a modification is made for a known choking cause. Before giving breaths, the rescuer should open the airway using a head-tilt/chin-lift and look into the mouth for any visible object. If seen, it should be carefully removed with a finger sweep, but only if it is clearly visible and easily accessible to avoid pushing it deeper [55].

6. Evidence-Based Interventions:

Back blows have been a cornerstone of choking first aid for decades, particularly for infants. The technique's physiological basis is the combination of gravity, percussive force, and vibration. When a victim is positioned with the head lower than the chest, gravity assists in moving the object toward the mouth. The sharp, forceful blow between the shoulder blades creates a vibration and an instantaneous increase in intrathoracic pressure, which can theoretically displace the lodged object [56]. Despite its long-standing inclusion in guidelines, the evidence for the standalone efficacy of back blows is mixed. Some studies and case reports have documented successful dislodgment of objects using back blows alone, while others suggest that the force may sometimes impact the object deeper into the airway [57]. For this reason, major guidelines like those from the American Heart Association (AHA) and the European Resuscitation Council (ERC) no longer recommend using back blows in isolation for adults. Instead, for infants, they are the initial intervention in a sequence with chest thrusts, and for adults and children, they are often omitted in favor of proceeding directly to abdominal thrusts, or are used in an alternating cycle with them in some protocols (e.g., five back blows followed by five abdominal thrusts) [58].The abdominal thrust, or Heimlich maneuver, remains the most widely recognized and recommended intervention for a conscious choking adult or child over one year of age. Its evidence base, while largely built on case series and physiological plausibility rather than randomized controlled trials (which are ethically and logistically challenging for such emergencies), is robust. The maneuver works by displacing the diaphragm upward, compressing the lung volume, and forcibly expelling the residual air trapped in the lungs. This generates a rapid, artificial cough that propels air from the lungs up through the trachea at a peak flow rate that can exceed 200-300 L/min, sufficient to eject most obstructions [59]. Dr. Henry Heimlich's original publication in 1974 documented its success in dislodging food from the airways of multiple choking victims, and since then, thousands of case reports have attested to its life-saving efficacy [60]. Systematic reviews of choking incidents consistently identify abdominal thrusts as the most frequently successful technique for relieving a complete FBAO in conscious victims, solidifying its position as the primary intervention in current guidelines [61].However, the application of abdominal thrusts is not without risk, and the evidence of complications has directly shaped the guidelines for special populations. Reported complications include injuries to abdominal and thoracic viscera, such as rupture of the stomach, spleen, or liver, and in rare cases, mesenteric laceration or aortic injury [62]. There have also been cases of regurgitation and aspiration of gastric contents. These risks are significantly elevated in certain groups. Consequently, for victims who are in the late stages of pregnancy or who are visibly obese, abdominal thrusts are contraindicated. The enlarging uterus in pregnancy or the large abdominal girth in obesity prevents effective sub-diaphragmatic compression and poses a risk to the fetus. For these individuals, chest thrusts are the recommended alternative. The hand placement for chest thrusts on a conscious victim is identical to that for chest compressions in CPR—on the lower half of the sternum—and the thrusts are delivered in a backward direction, achieving the same goal of increasing intrathoracic pressure to create an artificial cough without the abdominal risks [63].The management of the unconscious choking victim represents the most critical integration of these techniques into a structured, evidence-based protocol. Once a victim loses consciousness, the procedure transitions from a series of standalone maneuvers to a modified form of cardiopulmonary resuscitation (CPR). The 2020 AHA Guidelines provide a clear, step-by-step sequence. After confirming unresponseness and calling for emergency help, the rescuer begins CPR but with a crucial modification: before delivering rescue

breaths, they open the airway and look for any visible object in the mouth, removing it only if it is clearly seen [64]. They then attempt to give two rescue breaths. If the breaths do not make the chest rise, indicating a persistent obstruction, the rescuer does not waste time with further blind finger sweeps. Instead, they immediately begin cycles of 30 chest compressions. These compressions are the primary intervention at this stage, serving a dual purpose: they provide minimal circulation to the brain and heart, and, more importantly for the choking victim, they function as repeated chest thrusts, generating the intrathoracic pressure needed to dislodge the object [65]. After each set of 30 compressions, the airway is opened and checked before the next breath attempt. This cycle continues until the obstruction is cleared, advanced help arrives, or the victim shows signs of life.Beyond these core techniques, other interventions exist, though their evidence base and recommendation level vary. Manual extraction with fingers is only advised if the object is clearly visible, as blind finger sweeps in an unconscious adult or child can push the object deeper. For healthcare professionals in equipped settings, direct laryngoscopy and Magill forceps removal are the gold standard. Suction devices designed for the upper airway have emerged in the consumer market, but current evidence from organizations like the AHA is insufficient to support or refute their routine use, and they are not a substitute for proven manual techniques. Ultimately, the hierarchy of evidence-based interventions is clear: for a conscious victim, abdominal thrusts (or chest thrusts for special populations) are first-line; for an unconscious victim, integrated CPR with an emphasis on chest compressions and visual airway checks is the standard of care that offers the best chance of survival [66].

7. Outcomes, Complications, and Post-Rescue Care

The outcomes of choking incidents exist on a broad spectrum, with time to successful intervention being the most critical determinant. Tragically, fatal outcomes are common, particularly when the obstruction is complete and no one present is trained in first aid. Hypoxic brain injury begins within minutes of complete airway obstruction, and cardiac arrest typically follows within 4 to 6 minutes in adults [67]. Even with successful resuscitation, anoxic brain injury can leave survivors with permanent neurological deficits. However, when a trained bystander intervenes promptly with appropriate techniques, the success rate is high. Many victims expel the object and recover fully with no immediate apparent sequelae. It is this latter group that is often at risk for having their post-event needs overlooked, as the visible crisis has resolved. Regardless of the apparent success of the rescue, any victim who required intervention for a choking episode should seek a professional medical evaluation, as internal injuries or retained fragments may not be immediately obvious [68].Complications following a choking incident can be categorized as those resulting from the obstruction (organic) and those resulting from the rescue attempts (iatrogenic). The primary organic complication is aspiration pneumonia, which occurs when gastric contents or oropharyngeal secretions are inhaled into the lungs during the period of struggle or after the object is dislodged. This can lead to a significant inflammatory response and bacterial infection [69]. Symptoms, such as fever, cough, and shortness of breath, may develop hours or days after the event. Another serious organic concern is the retention of a fragment of the foreign body in the airway. A small piece of food or a broken toy part can migrate deeper into the bronchial tree, leading to a persistent cough, wheezing, recurrent pneumonia, or lung abscess formation, sometimes weeks or months later [70]. For this reason, a persistent cough after a choking event warrants a thorough investigation, including chest radiography or bronchoscopy.Iatrogenic injuries, though incurred during life-saving efforts, are a well-documented risk of choking first aid. Abdominal thrusts, while highly effective, are associated with a range of potential injuries. The most commonly reported include injuries to the abdominal viscera, such as gastric rupture, mesenteric laceration, and traumatic injury to the liver, spleen, or pancreas [71]. There have also been rare case reports of aortic injury and fractures of the xiphoid process or ribs. Chest thrusts, while safer for the abdomen, carry a risk of rib fractures and sternal injury, similar to those seen with CPR. For infants, the risk of injury from improperly performed back blows or chest thrusts, while lower than that from inappropriate abdominal thrusts, still exists and can include soft tissue injury or, in extreme cases, thoracic organ damage [72]. The presence of abdominal pain, tenderness, vomiting, or signs of internal bleeding after receiving abdominal thrusts necessitates immediate medical attention.Therefore, a standardized protocol for post-rescue care is imperative. The first step, even for a victim who appears fully recovered, is a mandatory evaluation by a healthcare professional. The rescuer should strongly encourage the victim to go to the nearest emergency department or visit their physician promptly. This evaluation should include a detailed

history of the event and a physical examination. Depending on the circumstances, the clinician may order imaging studies, such as a chest X-ray to rule out aspiration or a retained fragment, or an abdominal X-ray or CT scan if there is suspicion of visceral injury from thrusts [73]. For any victim who lost consciousness, even briefly, or required CPR, transport to an emergency department via ambulance is non-negotiable, as they require advanced monitoring and possibly neurological evaluation.Beyond the physical ramifications, the psychological impact of a choking event can be profound for both the victim and the rescuer. The victim may develop a phobia of eating certain foods (sitophobia), anxiety, or post-traumatic stress disorder (PTSD), characterized by flashbacks, nightmares, and avoidance behaviors related to eating [74]. This is particularly common in children. For the rescuer, even in a successful outcome, the intense stress of the situation can lead to acute stress reaction or longer-term psychological effects. They may experience guilt, anxiety, or repeatedly ruminate on the event. Therefore, psychological first aid and access to counseling should be considered an integral part of post-rescue care [75]. For victims, especially children, counseling can help process the trauma and prevent the development of lasting feeding disorders.Finally, a choking event should be viewed as a critical teachable moment for prevention. Before discharge from medical care, a healthcare provider should counsel the victim and their family on choking prevention strategies tailored to the individual's age and risk factors [76]. This includes guidance on safe food preparation (cutting food appropriately), educating parents on age-appropriate toys, and advising the elderly or those with dysphagia on dietary modifications and safe swallowing techniques. For rescuers, particularly those in community or professional settings, a structured debriefing session can be invaluable. It allows them to process the event, review the techniques used, reinforce correct procedures, and address any questions or emotional distress, thereby building resilience and preparedness for future emergencies [77].

8. Conclusion

In conclusion, the effective management of a choking emergency is a critical skill that hinges on a clear understanding of airway anatomy, the ability to rapidly assess the severity of the obstruction, and the precise application of age- and situation-appropriate techniques. This research has delineated the stark contrast between the response for a conscious adult, which relies primarily on abdominal thrusts, and that for an infant, for whom a sequence of back blows and chest thrusts is mandatory. It has been established that the environment plays a significant role in risk, necessitating tailored prevention efforts from the childproofed home to the safety-conscious workplace. Crucially, the successful dislodgment of an object is not the terminal point of care; the potential for medical complications like aspiration pneumonia or visceral injury, coupled with the profound psychological impact on both victim and rescuer, mandates a comprehensive post-rescue protocol involving medical evaluation and psychological support. Ultimately, widespread, standardized public education in these evidence-based protocols is paramount. Empowering individuals with this knowledge transforms passive bystanders into potential lifesavers, bridging the critical gap between the onset of a choking event and the arrival of professional medical help, thereby safeguarding lives across all segments of society.

Author Statements:

- **Ethical approval:** The conducted research is not related to either human or animal use.
- **Conflict of interest:** The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper
- **Acknowledgement:** The authors declare that they have nobody or no-company to acknowledge.
- **Author contributions:** The authors declare that they have equal right on this paper.
- **Funding information:** The authors declare that there is no funding to be acknowledged.
- **Data availability statement:** The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

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