LifeVac

Medical Journal Information

1. American Journal of Emergency Medicine
2. American Journal of Gastroenterology
3. The World Congress of Gastroenterology
4. The American College of Emergency Physicians
5. The American Broncho-Esophagological Association (ABEA)
6. International Journal of Clinical Skills
7. International Journal of Pediatric Otorhinolaryngology

1.

THE AMERICAN JOURNAL OF EMERGENCY MEDICINE

American Journal of Emergency Medicine 34 (2016) 1673–1730

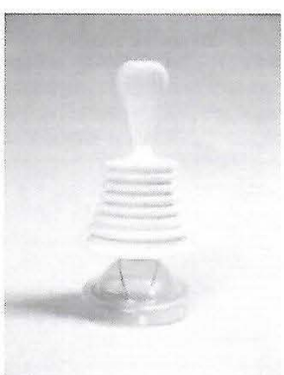
Contents lists available at ScienceDirect

American Journal of Emergency Medicine

journal homepage: www.elsevier.com/locate/ajem

Correspondence

Assessment of the LifeVac, an anti-choking device, on a human cadaver with complete airway obstruction



We performed an independent study to determine whether the anti-choking device, LifeVac, is capable of removing a food bolus from an obstructed airway when the potential for choking as a medical emergency exists.

The LifeVac is a non-powered, single patient, portable suction apparatus (anti-choking device) developed for resuscitating choking victims when standard current choking protocol has been followed without success. The LifeVac is designed with a patented valve to prevent air from exiting through the mask. This patented valve is designed to prevent the strong pulse of air from pushing food or objects further downward, lodging the blockage deeper into the airway of the victim. A one-way suction stream is thus created to remove the lodged food or object. The negative pressure generated by the force of the suction is 3 times greater than the highest recorded choke pressure. The mean peak airway pressure with abdominal thrusts is 26.4 ± 19.8 cmH20 and with chest compressions, 40.8 ± 16.4 cmH20, respectively ($P = .005$, 95% confidence interval for the mean difference 5.3–23.4 cmH20.) The LifeVac generates over 300 millimeters of mercury (mm Hg) of suction.

Each year, approximately 3000–4000 Americans die from choking. Children and the elderly present much higher risks for choking. At least one child dies from choking on food every five days in the U.S., and more than 10,000 children are taken to hospital emergency departments each year for food-choking incidents. Semisolid foods are the major cause of a large number of asphyxiations, especially among the elderly.

This study was conducted at Fusion Solutions, a cadaver based training center in New York. An unselected, recently diseased individual was employed in the study. The subject was a 71 year old, Caucasian female, 153 pounds, 65 inches with a Body Mass Index of 25. Medical history was remarkable for breast cancer.

The paramedic technician placed a simulated food bolus 7 to 10 centimeters into the subject's upper airway. The obstruction was visually and verbally confirmed prior to use of the LifeVac apparatus. Three simulated boli obstructions made of clay were used: a 2 cm (small), a 2 1/2 cm (medium) and a 3 cm (large) size. The simulated boli were attached to a string to maintain control during the study.

The paramedic technician placed an adult LifeVac mask on the cadaver following operating guidelines to remove the lodged bolus. The author observed and recorded the success rate. It was noted on one trial that a second pull was required to ensure a tighter seal following an initial failed trial. This achieved increased suction and ensured removal of the simulated bolus. The LifeVac removed the bolus successfully 49/50 trials on the first trial.

The American Red Cross' recent first-aid protocol de-emphasizes the use of the Heimlich for treating a conscious choking victim. The new

Figure 1. Placement of large simulated bolus (3 cm) 7-10 centimeters past tongue base into upper airway of subject.

Figure 2. Placement of LifeVac device on the cadaver using guideline protocol to achieve proper seal to operate device.

Figure 3. Picture of large simulated bolus (3 cm) lifted from airway.

protocol recommends calling 9-1-1, then giving the person several sharp blows to the back, right between the shoulder blades, with the heel of the hand. If this doesn't clear the obstructed airway, "abdominal thrusts" should be tried next, alternating with repeated back blows, until the person breathes freely or loses consciousness.

According to Langhelle et al., standard chest compressions are more effective than the Heimlich maneuver for treating complete airway obstruction by a foreign body.

The Heimlich maneuver on a frail individual who is in a wheelchair can be difficult to administer expediently. Complications include rib fractures, gastric or esophagus perforations, aortic valve cusp rupture, diaphragmatic herniation, jejunum perforation, hepatic rupture, mesenteric laceration. There has also been a new case of fatal hemoperitoneum due to hilar laceration of the spleen.

When treating a choking child, John Hopkins School of Medicine warns, " When applying the Heimlich maneuver, be careful not to use too much force so you don't damage the ribs or internal organs."

Choking is a medical emergency that warrants prompt, precise action by anyone available. This results of this study revealed that the LifeVac was able to clear a completely obstructed upper airway. Given the potentially life-or-death nature of given situations, the LifeVac is deemed to be a clinically effective alternative to current emergency protocol to save choking victims. Hence, the LifeVac can be utilized as a safe, simple and effective method to use in critical situations.

Speech Pathologists treat swallowing disorders. Dysphagia treatment consists of teaching compensatory strategies, aspiration precautions, appropriate diet and caregiver training to prevent risks for aspiration. The LifeVac is non invasive and can be used by anyone, both medical personnel and laypersons alike. Results of this study suggest that the LifeVac can be included as part of the guidelines used for basic life support management of choking victims.

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http://dx.doi.org/10.1016/j.ajem.2016.03.047

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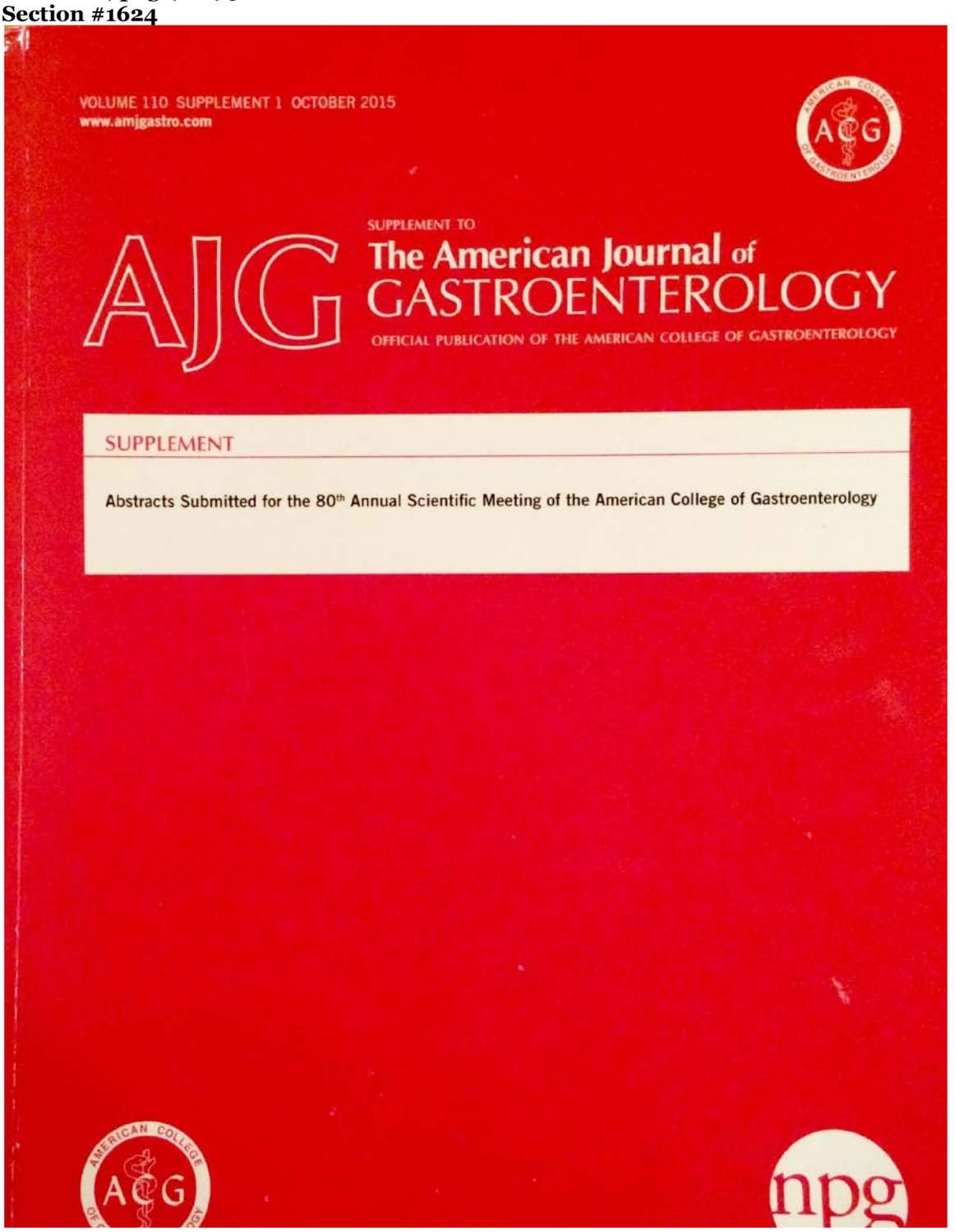
THE AMERICAN JOURNAL OF GASTROENTEROLOGY

LifeVac submission in the AJG (American Journal of Gastroenterology)
Volume 110, Supplement 1, October 2015
Abstracts, page, S695
Section #1624



of effect measure (odds or risk ratio), was original, used the individual as the unit of analysis and published after 2000. Each study was weighted according to its inverse variance. The distribution of effect measures were examined using visual and tabular displays as well as tests of homogeneity to reveal variation in the risk estimates of histologic BE occurrence between AA and nHw using a DerSimonian-Laird random-effects method. Odds ratio was calculated along with 95% confidence interval estimates. Forest plots were conducted and summary odds ratio with 95% CI of histologic BE was reported. Heterogeneity was quantified using the I2 statistic. A sensitivity analysis was performed comparing results with and without case control studies. Software used to conduct the meta-analysis was the open source OpenMetaAnalyst platform.

Results: A total of 8 eligible studies reporting histologic confirmation of BE in either AA or nHw. Analysis including the case control study demonstrated a nearly 400% increased risk for nHw patients having histologic BE compared to AA (OR 3.949, 95% CI 3.069-5.082, figure 1). In the random effects model without the case control study, the risk of histologic BE remained elevated at approximately 360% in nHw compared to AA (OR 3.618, 95% CI 2.769-4.726, figure 2). Heterogeneity was not present in either model (case control included I2=17%, p=0.296, figure 1; without case control I2=0%, p=0.42, figure 2).

Conclusion: In a meta-analysis of studies that examined histologic confirmation of BE between AA and nHw, we observed that nHw had a risk of histologic BE between 3.6 and 4 times higher than AA. Investigation into understanding any molecular/genetic mechanisms underlying this risk disparity is warranted.

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LifeVac: A Novel Apparatus to Resuscitate a Choking Victim

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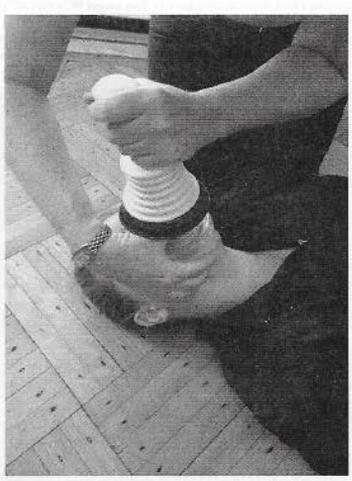
Introduction: Patients with oropharyngeal dysphagia are at increased risk for choking which can be a leading cause of death in this population. Currently there are no methods to remove an inhaled object if the traditional Heimlich maneuver fails. We have developed an apparatus which is simple to use in order to remove an object lodged in the upper airway if the Heimlich maneuver fails.

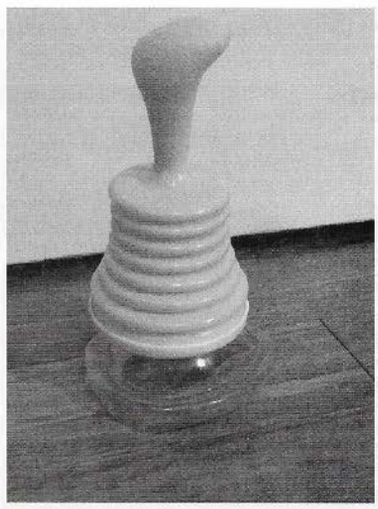
Methods: The Laerdaltm Choking Charlie simulator system designed specifically for training for the Heimlich abdominal thrust maneuver was used in order to simulate a choking victim. A Nathans Cocktail Frank cut in half was utilized as this food is responsible for many choking deaths. The item was pushed into the airway 7 cm from the lips in order to create an obstruction in the airway. The Lifevac unit was then utilized per the products instruction manual to attempt to dislodge the object and the frequency of dislodging the object was recorded.

Results: Using Laerdal Choking Charlie with a hot dog piece inserted into the airway the Lifevac successfully removed the object 470 out of 500 attempts in one useage, in 498 out of 500 attempts with two useages, and was successful 500 out of 500 attempts in three useages. The 95% confidence interval for the probability of success (S) of the device (when defining success as removal in one usage) = 91.5% < S < 95.9%. The 95% confidence interval for the probability of success (S) of the device (when defining success as removal in two or fewer usages) = 98.5% < S < 99.9%.

Conclusion: Lifevac is a promising apparatus that is simple to use and appears to be an extremely effective method in successfully dislodging an object lodged in the airway of a choking victim. Further studies with cadavers and subsequent pilot studies in humans are warranted in the hopes of saving lives when the Heimlich maneuver fails.



[1624A] Figure 1.



[1625B] Figure 2.

1625

Lower Oropharyngeal Acid Exposure and Higher Psychological Distress Exists Amongst Subjects With Laryngeal Symptoms and Response to PPI Therapy

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Introduction: Predicting therapeutic response in patients with laryngopharyngeal reflux (LPR) symptoms is challenging. Consequently, patients with suspected LPR often receive empiric proton-pump inhibitor (PPI) therapy and up to 50% may not respond. The Restech Dx-pH probe is a transnasal catheter that measures oropharyngeal pH. We hypothesized that higher oropharyngeal acid burden is associated with a greater PPI response. The aims of this study were to (1) correlate oropharyngeal pH probe parameters with PPI response and (2) evaluate if alternative clinical surrogates predict PPI response.

Methods: This was a physician blinded prospective cohort study conducted at a tertiary care teaching institution between 1/2013 and 10/2014. Adult subjects with laryngeal symptoms >1 month and a Reflux Symptom Index score (RSI) ≥13 off PPI therapy 2 weeks prior to study were recruited from an otolaryngology clinic. Laryngoscopy and oropharyngeal pH assessment with the Restech Dx-pH system were first performed, followed by an 8 to 12 week trial of omeprazole 40 mg once daily. Prior to, and following PPI therapy, subjects completed various symptom questionnaires [Table 1]. PPI response was defined as > mean delta RSI (difference between pre- and post-PPI therapy RSI).

Results: Of 34 subjects, 15 (44%) had a PPI response. Percent time of oropharyngeal pH below 5.0 did not correlate with change in RSI (Spearman's rho -0.07, P=0.7); similar trends were seen for pH < 4.0, 5.5 & 6.0. Low acid exposure (< 1%) was significantly associated with PPI response when compared to high acid exposure (≥1%) [Figure 2]. PPI responders had higher psychological distress scores prior to treatment and a significantly greater reduction in post-treatment Brief Symptom Index, Negative Affect, and Heartburn Vigilance Scale scores. Baseline and delta GerdQ scores were significantly higher in the PPI responder group.

Conclusion: Contrary to our hypothesis, low oropharyngeal acid burden was associated with PPI symptom response, suggesting a non-acid mechanism of laryngeal symptoms in this group. PPI responders had higher psychological distress, indicating an association between cognitive affective symptoms and laryngeal complaints and supporting the placebo effect of PPI therapy. The etiology of laryngeal symptoms is undoubtedly complex, and the role of oropharyngeal pH testing to predict PPI response remains unclear.

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Interference With Daily Activities and Major Adverse Events During Esophageal pH Monitoring With Bravo® Wireless Capsule Versus Conventional Intranasal Catheter: A Systematic Review of Randomized Controlled Trials

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Introduction: For three decades, ambulatory 24-hour intranasal pH monitoring has been the established gold standard for detecting acid reflux in patients with refractory gastroesophageal reflux disease. However, device-associated adverse events and unpleasant experiences, reported by patients

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The World Congress of Gastroenterology

Successful Resuscitation of Choking Victims Using a Lifevac, a Non-powered Portable Suction Device: Real World Experience

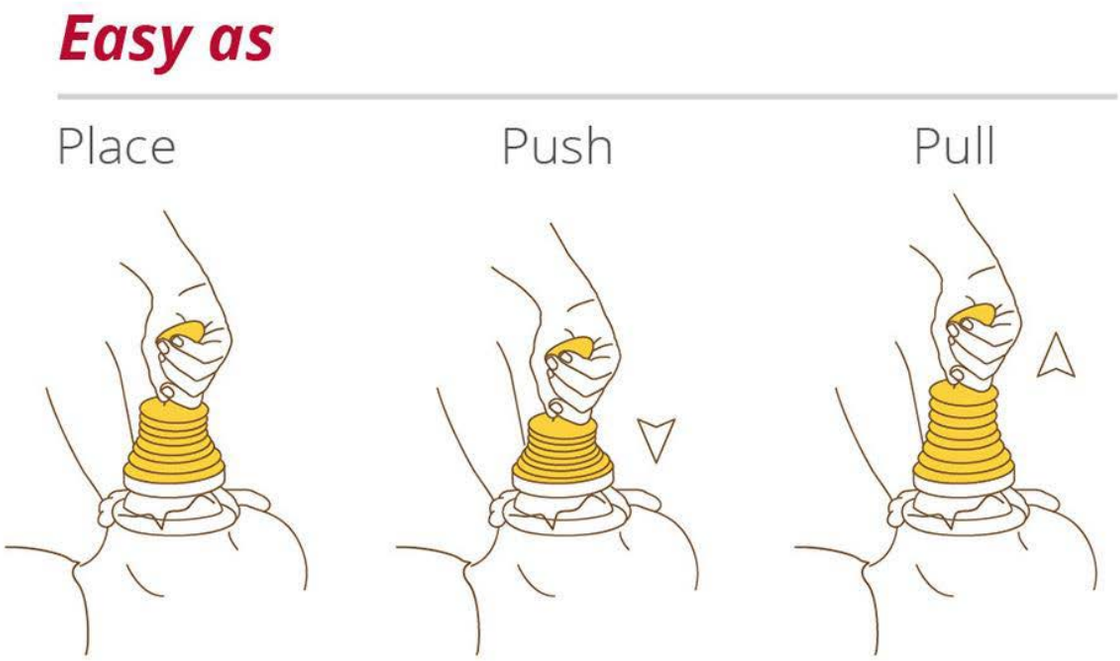
Abstract Category: Esophagus
Abstract Type: Clinical Vignettes/Case Reports

Abstract Body

Choking is a leading cause of accidental death worldwide and in the United States. Patients with oropharyngeal dysphagia are at a high risk for aspiration of food and thus, choking. Although there have been great technological advances, currently, there is no approved device to assist in the resuscitation of a choking victim when abdominal thrusts fail. Recently, a portable, non powered suction device called LifeVac has been developed and introduced globally. This device consists of a one way valve and a plunger attached to a standard face mask. When the plunger is pushed down, air escapes out the sides of the valve and not into the victim's airway; when the plunger is pulled back, negative pressure is generated and it suctions out the lodged material. Here we report several real-life cases in which this apparatus has been successfully used to resuscitate a choking victim.

A care home in Wales obtained several LifeVac devices for their residents. During lunch, a resident of this care home began choking on a piece of meat, lost consciousness, began turning blue. A nurse in the home attempted usual methods of assistance without any success. Therefore, the LifeVac device was used according to directions, and with one pull, the meat piece was dislodged. A physician was then called. The physician examined the patient and noted no adverse effects. Additionally, no further intervention was required. The same care home reported that 1 week later, another patient suffered a similar episode and the device was again successfully used to dislodge a meat piece through suctioning into the unit.
In addition, a LifeVac device was obtained by a family in Idaho and was kept at home in case of a choking emergency. On April 23, 2017, a woman in her late 60s with no underlying medical condition began choking at the dinner table on a meat piece. She was unable to speak and was wheezing. Her son unsuccessfully attempted the Heimlich maneuver; thus the LifeVac device was used as per instructions, and with one pull the meat piece was dislodged into her mouth. She did not require further medical attention.

These dramatic real-life case reports demonstrate the utility of this non powered suction device. Certainly, these testimonials show that lives were saved and major morbidity and mortality avoided. Further studies are urgently needed as there is a need for such a suction device when abdominal thrusts fail to address choking.



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4.

THE AMERICAN COLLEGE OF EMERGENCY PHYSICIANS

LIFEVAC- A NOVEL DEVICE FOR THE RESUSCITATION OF THE ADOLESCENTCHOKING VICTIM

Author Block: *Lisa Lih-Brody*, *Michael Singer*, *Edward Brody Jr.*. ProHealth Care Associates, Rockville Centre, NY, Lifevac LLC, Springfield Gardens, NY

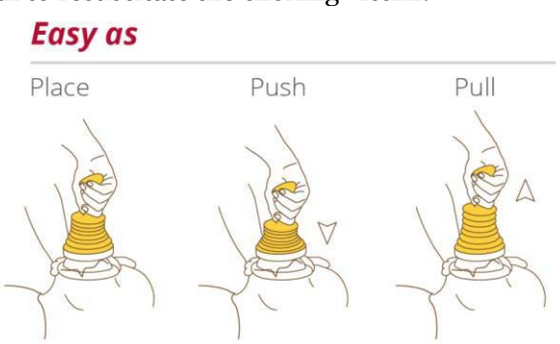
Abstract:

Study Objective- Choking remains a leading cause of tragic death in children and adolescents. Currently there are no devices that are accepted to assist in the resuscitation of an adolescent choking victim. Therefore we studied the Lifevac, a new apparatus that previously has been shown in a simulator model to successfully resuscitate an adult choking victim, in an adolescent simulator model.

Methods- The Laerdel choking adolescent simulator system was utilized and a hot dog piece was inserted one and one half inches into the airway. The Lifevac was then used per operating guidelines with the pediatric mask attached to attempt to remove the lodged object and the outcome was recorded.

Results- The Lifevac successfully removed the obstructing hot dog in 472 out of 500 attempts in one attempt, in 497 out of 500 in two attempts, and all obstructions were removed in three attempts. The 95% confidence intervals for the point estimate of the probability that the device will remove the obstruction (calling the point estimate "S") shown for three scenarios depending on how you define success: success 1 attempt: $0.92 \leq S \leq 0.96$, success 2 attempts: $0.98 \leq S \leq 1.0$, success 3 attempts: $0.99 \leq S \leq 1.0$ 99% confidence intervals for the point estimate of the probability that the device will remove the obstruction (call the point estimate "S") shown for three scenarios depending on how you define success: success 1 attempt: $0.91 \leq S \leq 0.97$, success 2 attempts: $0.98 \leq S \leq 1.0$, success 3 attempts: $0.99 \leq S \leq 1.0$

Conclusion- The Lifevac is an apparatus that can successfully remove a hot dog, which is a food that commonly leads to choking, lodged in an adolescent choking victims airway in this simulator model. This apparatus deserves further study as there is potential to save lives if abdominal thrusts fail to resuscitate the choking victim.



Author Disclosure Information:
L. Lih-Brody: ; Lifevac LLC. **M. Singer:** ; Lifevac LLC. **E. Brody:** Lifevac LLC.

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THE PROGRAM

OF

THE NINETY EIGHTH ANNUAL MEETING

OF

The American Broncho-Esophagological Association

Wednesday, Thursday, and Friday

April 18-20, 2018

The American Broncho-Esophagological Association (ABEA)

Novel use of a portable, non-powered, suction-generating device for management of life-threatening aerodigestive tract foreign bodies

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Abstract:
Objective: Foreign body aspiration causes thousands of deaths every year, particularly in children, the elderly, and adults with dysphagia. While operative techniques have been described for patients stable enough for transport to a medical facility, opportunity exists for improvement in pre-hospital management. Here we summarize data assessing a portable, non-powered, high suction-generating device which can be applied in the emergent resuscitation of patients suffering acute respiratory distress from foreign body aspiration.

Methods: The PubMed and MEDLINE databases were comprehensively screened using broad search terms. All identified citations were reviewed systematically. Further product testing materials, published abstracts, and anecdotal case reports related to the device were reviewed. A summary is herein presented.

Results: Laboratory testing demonstrated that this device generates peak airway pressures 8 to 10 times that of standard chest compressions and abdominal thrusts. A simulation study showed 94% reliability in retrieving upper aerodigestive tract foreign body. In a similar cadaveric study, there was 98% reliability in retrieving foreign bodies of varying sizes from the upper airway. The rate of success in both studies approached 100% with multiple attempts. Several case reports have also shown successful application in the emergent management of airway foreign body in elderly and dysphagia patients.

Conclusion: Portable suction-generating devices may play an important role in the emergent, non-operative, pre-hospital management of upper aerodigestive tract foreign body aspiration, particularly in settings and populations with high choking risk. Further characterization of effectiveness and safety in larger cadaveric or simulation studies mimicking physiologic conditions is indicated.

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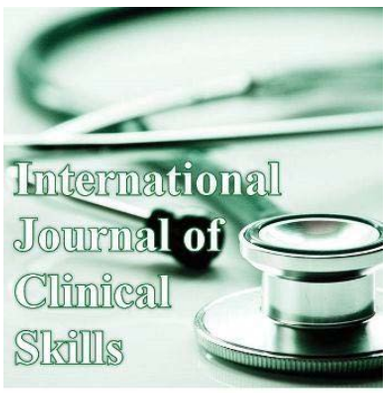

ISSN 1753-0431 (Print)1753-044X (Electronic)

Successful Use of a Novel device called the LifeVac to Resuscitate Choking Victims- Worldwide Results

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Abstract

Choking remains the fourth leading cause of accidental death worldwide. Despite major medical advances in other areas, there currently are no devices that exist to assist in the resuscitation of a choking victim when the standard abdominal thrusts and back blows fail. The LifeVac is a portable, non-powered suction device that was created for the resuscitation of a choking victim when standard protocol fails. It is noninvasive and simple to use, thus making it attractive for use in choking emergencies. This article describes results of worldwide experience using the LifeVac in real life emergencies. Thus far the unit has been used successfully 100% of the time with limited to no side effects reported. The use of LifeVac has huge potential to save thousands of people from choking, including more susceptible populations such as children and the elderly. It can be used by EMS in the field, and the device could prove valuable in hospitals, nursing homes, day care centers, and other settings. Based on these encouraging results the LifeVac device should be considered as an option during a choking emergency when standard protocol fails.

Keywords- Choking, Resuscitation, Anti choking device, LifeVac

Introduction

Choking is a leading cause of accidental death throughout the world. According to the American Red Cross more than 3,000 people die each year in the United States alone as a result of choking (1), and according to Injury Facts 2016, choking is the fourth leading cause of unintentional death (1). At highest risk of choking are the extremes of age: of the 4,864 people who died from choking in 2013, 2,751 were older than 75 (1). In addition, choking is a leading cause of death among children, especially those under 4 years old (2). Worldwide, a child dies every five days from choking on food. Choking is also a leading cause of brain injury in young children. When food or other small objects obstruct the airway, oxygen deprivation for just a few minutes may result in brain damage (3). More than 17,000 children are treated in hospital emergency rooms for choking related injuries each year (4).

Unfortunately, despite these grim statistics, no advances have been made in the resuscitation of a choking victim since back blows were added to the American Red Cross ACLS protocol (5). Recently however a new device called the LifeVac seems to show promise in assisting a choking victim when back blows or abdominal thrusts fail. To our knowledge, in the past no device had been shown to successfully resuscitate a choking victim. In a choking emergency, time is critical as it can take EMS more than six minutes to arrive on the scene. At this point brain damage is already occurring and after 8 to 10 minutes damage is irreversible (6). Therefore, a device that is inexpensive, easy to use and readily available would be advantageous in such an emergency. The LifeVac is a portable, non-powered suction device that was developed for this reason. The device consists of a plunger with a one-way valve such that when the plunger is depressed air is forced out the sides and not into the victim and when the plunger is pulled back negative pressure is generated to suction out the obstructing object.

The LifeVac has been made available over the past several years worldwide. We herein report the successful use of LifeVac in ten cases that have been reported to date. LifeVac has previously been reported to be successful in removing a lodged object in both simulator (7) and cadaver (8) models. LifeVac is marketed in Europe with a class 1 CE mark, and the kit comes with contact information such that if the device is used feedback can be provided.

Case Report

Case No. 1, 2, 3: The incidents took place at an assisted living home in Wales. An 80 year-old female with dementia was eating lunch when suddenly she was noticed to be choking by the nursing home staff. Back slaps were attempted twice but with no result and the patient began losing consciousness. A nurse on duty then used the unit according to package directions and with one application the food bolus was successfully removed from the patient's airway. The patient recovered without any adverse sequelae. One week later the same patient had a similar choking episode and once again the LifeVac was successfully used to resuscitate the patient.

In the same care home several months later, a 70 year-old male with Parkinson's was noted to be choking while eating. The LifeVac was used per instructions and the obstructing food was successfully suctioned to the mouth where the nurse could then finger sweep it out.

Case No. 4: Another case of a life saved using LifeVac occurred on September 7, 2015 in New Jersey. The patient, a female, was 31 years old and is wheelchair bound. The patient suffers from dysphagia, or difficulty swallowing, since a young age. She began to choke on her tuna sandwich while eating lunch. Her mother unsuccessfully began performing abdominal thrusts. With the patient supine, the LifeVac successfully removed the obstructing food.

Case No. 5: On April 23, 2017 in Idaho, LifeVac was used in a private home. The device was bought for children who have had choking episodes. On April 23, it was used on a guest to the home, a 60 year old female with no medical issues who choked on a piece of meat during dinner. Abdominal thrusts were attempted right away, but unsuccessfully. The patient was the placed supine on her back on the floor. The LifeVac was then applied and with one suction, the piece of meat was removed from the airway. No adverse effects were noted.

Case No. 6: On September 6, 2017 in Spain in a Parkinson center, there was yet another life saved using LifeVac. The patient was an 80-year-old male who choked on meat while eating. A nurse attended to the patient, giving 5 back blows followed by 5 abdominal compressions. When these were unsuccessful, she applied the LifeVac per operating instructions and with four applications the food was dislodged.

Case No. 7: On October 4, 2017, LifeVac was used in a New York assisted living facility. The patient was an elderly male in a wheelchair who choked while eating a sandwich. The attendants were unable to perform abdominal thrusts due to his wheelchair status and instead used the LifeVac right away, which cleared the full airway blockage and dislodged the food. Later, a medical exam was performed including x-rays, which showed no adverse effects.

Case No. 8: On October 31, 2017 in Greece, the patient was a 40-year-old female who choked on a piece of garlic. EMS was called and arrived two minutes later. The emergency personnel performed abdominal thrusts as well as back blows but they were unsuccessful. Four minutes later, an EMS rescuer used LifeVac and with 3 attempts, the garlic piece was removed. The patient's vital signs were all normal, and again no adverse events were reported. In addition the EMS team had a body camera and the entire resuscitation was captured on video.

Case No. 9: LifeVac was used on a 70 year old female with Huntingtons disease in a home care facility in the UK who choked on a sandwich during mealtime and become unconscious. The LifeVac was then used and required three pulls and the sandwich piece was successfully removed and was observed in the mask. The person operating the device was the 63 year old care manager. The patient briefly required CPR and was brought to the hospital where no adverse effects were reported and the patient was able to be returned to the home the next day.

Case No. 10: LifeVac was used successfully was in the United Kingdom where the patient was a 68-year-old male with Downs syndrome in a wheelchair who weighs 54 kg. The patient began choking on a piece of chocolate. A layperson saved the patient with 2 pumps of LifeVac and removed the obstruction successfully. Again. no adverse events were reported.

Discussion

Choking emergencies constitute a common, potentially preventable cause of accidental death throughout the world. Despite medical advances, there are currently no devices that have been shown to successfully resuscitate a choking victim if abdominal thrusts and back blows fail. LifeVac has been previously reported to successfully remove an object from the airway in both a cadaver and a simulator model. Unfortunately, it is extremely difficult to study this device in live humans and there is no animal model suitable for study. The LifeVac is a lightweight, portable, non-powered suction device (Figure 1) that is applied to the patient's face via a face mask, which comes with the unit in adult and pediatric sizes. A patent pending one-way valve on the plunger generates negative pressure. On downward thrust of the plunger, air is forced out the sides of the device and not into the victim. (Figure 2) This avoids the possibility of pushing an obstructing object further into the airway. A negative pressure is then generated by pulling up on the plunger {Figure 1}, thus removing the object. Since the device does not require placement of any part into the oropharynx there is no risk of pushing a lodged object further into the airway. Risks can include edema and bruising from the generated suction, but the benefit of saving a life clearly outweighs these small risks. It is interesting to note that the case reports were voluntary in their submission but represent populations at known risk for choking. There were no reports of the use of the device where it was unsuccessful. Based on the successful application of the LifeVac in real life situations described in this report, the LifeVac should be available for use in settings with high risk for choking such as nursing homes and day care centers, and possibly all public eating facilities. In addition, it would be beneficial for EMS to carry for use in the field. LifeVac may be a viable option in a choking emergency when standard protocol fails.

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Figure Legend
Fig (1). The LifeVac Device
Fig (2). Easy Technique Using LifeVac

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International Journal of Pediatric Otorhinolaryngology

www.elsevier.com/locate/ijporl

Volume 115, December 2018 ISSN 0165-5876

Available online at www.sciencedirect.com

ScienceDirect

International Journal of Pediatric Otorhinolaryngology

Portable, non-powered, suction-generating device for management of life-threatening aerodigestive tract foreign bodies: Novel prototype and literature review

Poster presentation at: Combined Otolaryngology Spring Meetings (COSM), American Bronchoesophagological Association (ABEA), National Harbor, Maryland, USA

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https://doi.org/10.1016/j.ijporl.2018.12.014Get rights and content

Abstract

Objective

To present a novel approach for the emergent, pre-hospital management of life-threatening aerodigestive tract foreign body aspiration using a portable, non-powered, suction-generating device (PNSD), in the context of a literature review of emergent pre-hospital management of patients with foreign body airway obstruction.

Methods

The PubMed and MEDLINE databases were comprehensively screened using broad search terms. A literature review of pre-hospital management and resuscitative techniques of foreign body airway obstruction was performed. Further, independent measurements of PNSD pressure generation were obtained. Application of a PNSD in cadaveric and simulation models were reviewed. A comparative analysis between a PNSD and other resuscitative techniques was performed.

Results

Physiologic data from adult and pediatric human, non-human, and simulation studies show pressure generation ranging from 5.4 to 179 cm H_2O using well-established resuscitative maneuvers. Laboratory testing demonstrated that a protypic PNSD demonstrated peak airway pressures of 434.23 ± 12.35 cm H_2O. A simulation study of a PNSD demonstrated 94% reliability in retrieving airway foreign body, while a similar cadaveric study demonstrated 98% reliability, with both studies approaching 100% success rate after multiple attempts. Several case reports have also shown successful application of PNSD in the emergent management of airway foreign body in elderly and disabled patients.

Conclusion

PNSDs may play an important role in the emergent, non-operative, pre-hospital management of upper aerodigestive tract foreign body aspiration, particularly in settings and populations with high choking risk. Further characterization of effectiveness and safety in larger cadaveric or simulation studies mimicking physiologic conditions is indicated.