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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

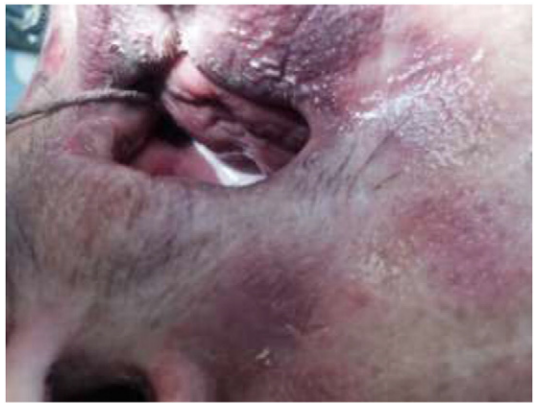

Figure 1. Placement of large simulated bolus (3 cm) 7-10 centimeters past tongue base into upper airway of subject.

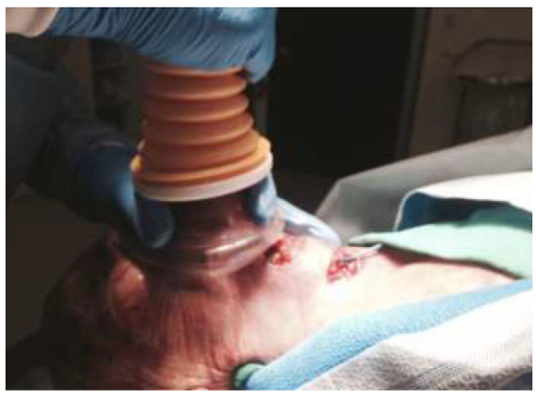

Figure 2. Placement of LifeVac device on the cadaver using guideline protocol to achieve proper seal to operate device.

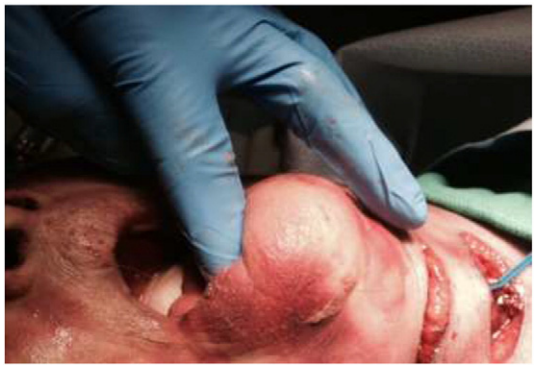

Figure 3. Picture of large simulated bolus (3 cm) lifted from airway.

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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Risk of transfusion-related acute lung injury after blood products transfusions

To the Editor,

We read with great interest the article "A Fresh Frozen Plasma to Red Blood Cell Transfusion Ratio of 1:1 Mitigates Lung Injury in a Rat Model of Damage Control Resuscitation for Hemorrhagic Shock" written by Zhao et al [1]. We believe that this original study provides an important approach to blood products transfusions for hemorrhagic shock. Use of blood products has not only many benefits but also many disadvantages. Therefore, we support to use blood products carefully and as many as necessary. We think that awareness of the risk of transfusion-related acute lung injury (TRALI) after unnecessary blood products transfusions is needed.

Massive transfusion is necessary for patients with hemorrhagic shock. An important component of massive transfusion guidelines is the amount of fresh frozen plasma (FFP) transfused. Some studies reported that administration ratio of FFP to red blood cells (PRBCs) has been important, but the optimal ratio during resuscitation has also been questioned. FFP transfusion may be an independent risk factor for acute lung injury and acute respiratory distress syndrome [2]. Some studies reported that there was a 2 times greater risk of acute respiratory distress syndrome due to a high FFP/PRBC ratio, and also, intensive care unit and hospital lengths of stay were significantly longer for patients who had received a high FFP/PRBC ratio [1,3,4]. Risks commonly associated with plasma transfusion include TRALI, transfusion-associated circulatory overload, allergic transfusion reactions, and infectious disease transmission. Recent studies have made comment about FFP transfusion and morbidity/mortality [5].

Transfusion-related acute lung injury is a clinical syndrome associated with all types of blood components transfusion containing plasma that usually includes dyspnea, hypoxemia, and bilateral pulmonary edema [6,7]. The diagnosis of TRALI is based on clinical findings developed within 6 hours after a blood product transfusion in the absence of another risk factor for the development of lung injury. The mechanism of TRALI has commonly been clarified by the transfusion of a blood product that includes anti–human leukocyte antigen or anti–human neutrophil antigen antibodies [8]. Treatment of TRALI should be supportive, with low tidal volumes for mechanical ventilation and maintenance of euvolemia. Some guidelines suggest steroid therapy. However, steroid therapy is controversial [9].

Compliance to current guidelines for blood components, especially for plasma, is essential to decrease risk for patients. A restrictive transfusion strategy may be associated with decreasing incidence of TRALI. Optimal transfusion guidelines should provide sufficient amount of blood products to improve clinical outcomes while avoiding complications such as TRALI [8]. However, standard resuscitation practice avoids plasma transfusions until after infusing crystalloid and red cells. The need for FFP transfusion should be assessed by laboratory coagulation tests [10]. Also, a study demonstrated that some colloids such as low–molecular weight dextran (mean molecular weight 40,000, Dextran 40; LMD) may be used, both clinically and experimentally, to improve the symptoms of various types of lung injury [11].

Transfusion-related acute lung injury may be a major cause of transfusion-associated morbidity and mortality from plasma transfusion. Finally, a recent review by Vamvakas and Blajchman [12] described 6 strategies to reduce transfusion-related mortality, one of which was "avoidance of unnecessary transfusions through evidence-based transfusion guidelines."

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