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An Extubation Protocol for Angioedema

Elizabeth Floyd, MD[1], Nira A. Goldstein, MD, MPH[1], Rauno Joks, MD[2], Miguel Mascaro, MD[1,3], Christine Liaw, MD[1,4], Bradley Dickson[1], Denny Varughese, MD[1,5], and Joshua Silverman, MD, PhD[1,6]

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Abstract

Angioedema—nonpitting edema of the mucous membranes and skin—most commonly occurs as a complication from the use of angiotensin-converting enzyme inhibitors. At our institution, the otolaryngology department has incorporated the use of the endotracheal tube cuff-leak test and bedside direct laryngoscopy to aid in timing for extubation of angioedema patients. Prospective data collection of patients presenting to the emergency department with angioedema was performed. Of 76 patients with angioedema, 9 required fiberoptic intubation. Intubation was performed at a median of 73 hours (range, 44-118). An endotracheal tube cuff-leak test was performed in 7 patients prior to extubation, and bedside direct laryngoscopy was also performed in 3 of these 7 patients to document resolution of laryngeal edema. The use of the endotracheal tube cuff-leak test and bedside direct laryngoscopy is an easy and inexpensive method to help determine eligibility for extubation in patients intubated for angioedema.

Keywords

angioedema, angiotensin-converting enzyme inhibitor, cuff leak, direct laryngoscopy

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Angioedema is nonpitting edema of the mucous membranes and skin, which can lead to life-threatening airway compromise when occurring in the upper aerodigestive tract.[1] The management of extubation in these patients is poorly described in the literature. The use of cuff-leak tests has been studied in the intensive care unit (ICU) literature as a predictor of upper airway obstruction and the need for reintubation for ICU patients in general.[2] At this institution, the otolaryngology department has incorporated the use of the cuff-leak test and bedside direct laryngoscopy (DL) to aid in timing for extubation of angioedema patients. The aim of this study is to describe the utility of these examinations in the management of extubation in these patients.

Methods

All patients who presented to the emergency department with angioedema and who received otolaryngology consults were eligible. The protocol was approved by the institutional review boards of the State University of New York Downstate Medical Center and the Kings County Hospital Center. Informed consent was obtained. Subjects completed a questionnaire, and the treating physician completed a standardized form addressing clinical course. Patients were treated with a standardized regimen consisting of intravenous dexamethasone, diphenhydramine, and H2 blocker. Airway interventions were carried about by the otolaryngology and anesthesia teams if the patient presented in extremis. Intubated patients were evaluated by a standard extubation protocol: (1) endotracheal ''cuff-leak'' evaluation and (2) bedside DL by the otolaryngology service with the MacIntosh blade. A leak was confirmed if the difference between expired tidal volume with the cuff inflated and deflated was at least

[1]Department of Otolaryngology, State University of New York Downstate Medical Center, Brooklyn New York, USA
[2]Division of Allergy and Immunology, State University of New York Downstate Medical Center, Brooklyn, New York, USA
[3]Tzikas Facial Plastic Surgery Center, Delray, Florida, USA
[4]Department of Urology, Mount Sinai Medical Center, New York, New York, USA
[5]Department of Otolaryngology–Head and Neck Surgery, Rutgers New Jersey Medical School, Newark, New Jersey, USA
[6]Department of Otolaryngology, Long Island Jewish Medical Center/ Northwell Health, New Hyde Park, New York, USA

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Corresponding Author:
Elizabeth Floyd, MD, Department of Otolaryngology, State University of New York Downstate Medical Center, 450 Clarkson Ave, Brooklyn, NY 11203, USA.
Email: Elizabeth.floyd@downstate.edu

Table 1. Demographics.[a]

Characteristic	Study Population	Intubated Patients
Sex		
Male	35 (46.1)	3 (33.3)
Female	41 (53.9)	6 (66.7)
Race		
African American	71 (93.4)	9 (100.0)
Hispanic	2 (2.6)	0
Mixed	1 (1.3)	0
Other	1 (1.3)	0
Unknown	1 (1.3)	0
Age, y, mean ± SD	60.9 ± 13.7	66.4 ± 11.2

[a]Values are presented as n (%) unless noted otherwise.

10% over 6 cycles.[3] DL was performed at bedside with or without additional sedation depending on the patient's comfort level.

Results

Between April 2013 and July 2015, 76 patients agreed to participate in the study, 9 of whom required intubation. Demographics are presented in **Table 1**. The angioedema resulted from an angiotensin-converting enzyme inhibitor in 7 patients and was idiopathic in 2 patients. Fiberoptic intubation was performed in the operating room, and extubation was performed in the ICU at a median of 73 hours (range, 44-118). Prior to extubation, 7 of 9 patients (77.8%) had a cuff-leak test, and 3 of those patients underwent DL (33.3% of intubated patients) for either a positive cuff-leak test or isolated laryngeal edema at initial presentation. The otolaryngology service was present for 2 of 9 extubations (22.2%). Unwitnessed extubations occurred in 2 of 9 patients (22.2%), which accounts for the 2 patients who did not receive cuff-leak tests prior to extubation.

All patients recovered, and there were no mortalities. One patient developed subglottic stenosis due to intubation and subsequently required a tracheostomy. One patient developed an aortic dissection while on the operating room table following intubation. He was managed conservatively and survived.

Discussion

The cuff-leak test was developed as a simple method to detect laryngeal edema in intubated patients prior to extubation. Definitions of a positive test (absence of a leak) have differed among studies, with some using a difference ≤110 mL between the expiratory tidal volumes with the cuff inflated and deflated and others using a difference of <10%, <12%, or <15.5%.[2,4] A systematic review of 11 studies by Ochoa et al[2] demonstrated that the absence of a leak predicted a high likelihood of upper airway obstruction (pooled odds ratio, 18.78; 95% CI, 7.36-47.92) and reintubation (pooled odds ratio, 10.37; 95% CI, 3.70-29.13). While the test was initially developed to aid the timing of extubation for children with croup, it is commonly applied to intubated adults and has become a reliable marker of laryngeal edema as a result of intubation.

DL was also performed as an adjunct to the cuff-leak test with equipment accessible in the ICU. Patients underwent DL if either they had a positive cuff-leak test or initial presentation showed isolated laryngeal edema. If there was oral cavity and oropharyngeal edema in addition to the laryngeal edema, then the presence of a leak was deemed sufficient if all oral cavity and oropharyngeal edema had resolved. If laryngeal edema was absent on DL and the patient could be reintubated orally by the ICU or anesthesia service, the patient was cleared for extubation. If the ICU team felt concern about potential reintubation, the otolaryngology service

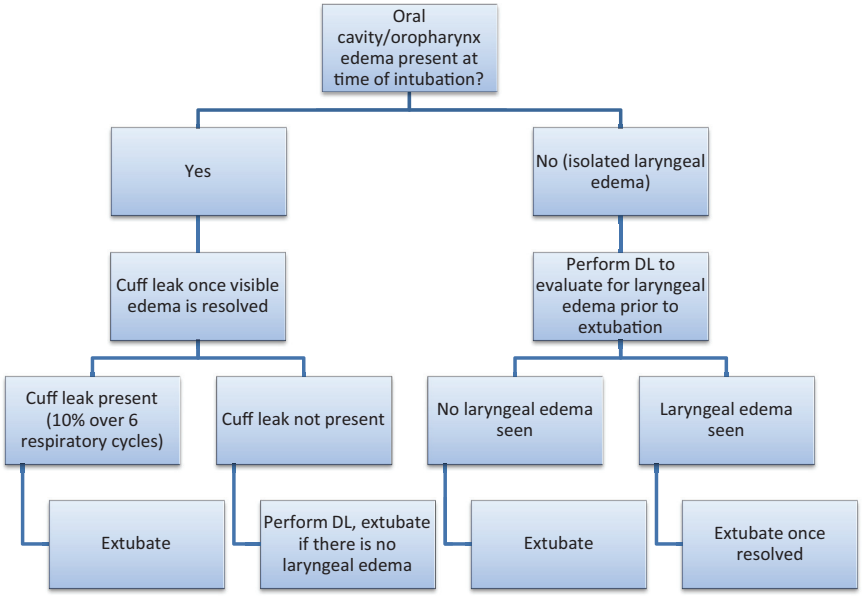

Figure 1. Paradigm for extubation in patients with angioedema. DL, direct laryngoscopy.

would be present for extubation, which occurred twice in our study.

The strength of our study was the prospective data collection with a standardized evaluation and treatment paradigm. Weaknesses of this study include the small sample size and potential selection bias, as those too sick to consent were often not recruited. The fact that 2 of 9 patients self-extubated is an area for improvement. This study is essentially a small pilot, and direct confirmation with a larger sample size would be needed to change management. We propose that future studies use our paradigm (**Figure 1**) to safely manage extubation in patients intubated for angioedema.

Conclusions

The use of the cuff-leak test and bedside DL is an easy and inexpensive method to help determine eligibility for extubation in patients intubated for angioedema.

Author Contributions

Elizabeth Floyd, lead author, data collection, final approval; **Nira A. Goldstein**, study design and conception, data collection, data analysis, principal investigator, contributing author, final approval; **Rauno Joks**, data collection, editor of manuscript, final approval; **Miguel Mascaro**, data collection, contributing author, final approval; **Christine Liaw**, data collection, contributing author, final approval; **Bradley Dickson**, data collection, contributing author, final approval; **Denny Varughese**, data collection, data interpretation, contributing author, final approval; **Joshua Silverman**, editor of manuscript, contributing author, data analysis andinterpretation, final approval.

Disclosures

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