

Hereditary angioedema education in otolaryngology residencies: survey of program directors

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Background: The objective of this work was to assess resident education regarding contemporary management of hereditary angioedema using a web-based survey.

Methods: An 11-item, multiple-choice, electronic questionnaire was sent to all 106 accredited otolaryngology training programs in November 2016. Questions focused on resident education, management principles, and formalized assessment.

Results: A total of 34 program directors responded, representing 32% of otolaryngology residencies. Ninety-seven percent believed otolaryngology residents should be knowledgeable in the management of hereditary angioedema due to C1 inhibitor deficiency (C1-INH-HAE). Specifically, 38% and 26% of program directors felt their residents were comfortable and very comfortable in C1-INH-HAE management, respectively. Of those surveyed, 18% have educational simulation activities and a protocol in place for C1-INH-HAE management. Forty-seven percent of respondents felt their training program provided adequate education and exposure to C1-INH-HAE. Over the last 5 years, 45% felt residents were exposed to 1 to 5 cases of C1-INH-HAE. Sixty-seven percent of residents were trained in the management of C1-INH-HAE through

in-person lectures. Seventy-one percent of programs had no formal assessment of resident competency in C1-INH-HAE management.

Conclusion: This study is the first to offer insight into C1-INH-HAE education and management principles in otolaryngology training programs. Surveyed program directors believe residents need a strong knowledge base in the management of C1-INH-HAE but less than half feel their trainees acquire the necessary exposure to this emergent disease process. Future research efforts in this area should aim to determine optimal educational activities as well as how to best incorporate this into otolaryngology residency curricula. © 2018 ARS-AAOA, LLC.

Key Words:

curriculum; education; hereditary angioedema; otolaryngology; patient care; quality improvement; residency; survey; training; universities

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Angioedema, also known as Quincke's edema or an-gioneurotic edema, was first described in 1586 by

Marcello Donati,¹ who wrote of a young count with developing lip edema from an egg allergy. The first clinical reference to hereditary angioedema due to C1 inhibitor deficiency (C1-INH-HAE) resulting in fatal suffocation was reported by Osler in 1885.² The presentation of angioedema without wheals varies between subtypes, although in all forms, it can occur within any organ system. The edema observed is non-pitting, with ill-defined borders, and may be flesh-colored or erythematous. Episodes may also be accompanied with either a burning or tingling sensation. Genetically, C1-INH-HAE is a rare Mendelian autosomal dominant disorder estimated to affect 1/10,000 to 50,000 individuals.³ This is caused by insufficient levels or dysfunction of the C1 esterase inhibitor (C1-INH), which is involved in regulation of the complement system. This decrease in functional C1-INH is believed to result in increasing levels of bradykinin, which has been implicated

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in the development of angioedema.⁴ Classically, there are 3 clinically indistinguishable types of C1-INH-HAE. Type I (80-85%) is caused by decreased production of normal functional C1-INH. Type II (15-20%) is caused by the production of normal levels of defective C1-INH. In C1-INH-HAE with normal C1-INH (previously termed Type III), C1-INH is neither deficient nor defective.⁵ Recently, 4 types of acquired angioedema (ie, idiopathic histaminergic acquired, idiopathic non-histaminergic acquired, acquired related to angiotensin-converting enzyme inhibitor, and acquired with C1-INH deficiency) and 3 types of hereditary angioedema (ie, hereditary with C1-INH deficiency, hereditary with FXII mutation, and hereditary of unknown origin) have been identified and described in a consensus statement crafted by Cicardi et al.⁶

Affected patients may experience intermittent attacks affecting many organ systems in an asymmetric distribution, including involvement of the head and neck (ie, eyelids, lips, tongue, and larynx) with concern for life-threatening laryngeal involvement, which may result in asphyxiation. Specifically, with regard to a disease distribution pattern, a relationship of 1:70:54 has been described for the larynx, skin, and abdomen, respectively.⁷ Of these episodes, laryngeal attacks with respiratory impairment are the most feared manifestation; patients may require emergent nasotracheal intubation, orotracheal intubation, tracheotomy, or coniotomy to provide a secure airway. It is estimated that up to 50% of C1-INH-HAE patients will experience at least 1 laryngeal attack within their lifetime; as many as one-third of laryngeal attacks are fatal if left untreated.⁸ The severity of these attacks is variable and related to a multitude of exacerbating factors and triggers, which include infections, medications, menses, stress, surgical procedures, and trauma. Fifty-percent of these attacks may be triggered by trauma or stress.⁹ Symptom onset usually begins prior to youth, with up to 75% of patients experiencing their first attack before 15 years of age.¹⁰

Currently, there is a paucity of literature with regard to otolaryngology resident training in the management of C1-INH-HAE, a field involving surgical procedures of the head and neck, which could precipitate C1-INH-HAE attacks. Furthermore, at our institution, otolaryngology is consulted on patients with a history or concern for C1-INH-HAE, particularly in the acute management of a patient's airway. Hence, the goal of this study is intended to better understand C1-INH-HAE practice patterns and education, as otolaryngology residents are likely to encounter situations where C1-INH-HAE management will be required of them in their present and future clinical practice.

Materials and methods

Study methodology and survey design were developed by all involved authors. This study was submitted and approved by the institutional review board at the Pennsylvania State University, College of Medicine

(STUDY00005921) on November 04, 2016. All procedures contributing to this work complied with the ethical standards of the relevant national and institutional guidelines on human experimentation, Penn State Hershey Medical Center Human Subjects Protection Office, and with the Helsinki Declaration of 1975, as revised in 2008. On November 23, 2016, an 11-item multiple-choice questionnaire (Appendix) was sent electronically to program directors of all 106 accredited otolaryngology residency programs in the United States using the Research Electronic Data Capture (REDCap) web survey application. Potential respondents were provided with the following instructions:

This brief survey contains questions regarding general practice patterns as well as educational exposure during otolaryngology residency in the management of hereditary angioedema. This survey is 11 questions in length and should take no more than 5 minutes of your time. Participation is both anonymous and voluntary, you can stop taking the survey at any time.

Questions focused on resident education, management principles, and formalized assessment. Questions were in part designed using an existing validated survey methodology regarding otolaryngic allergy.^{11,12} All program director responses were included in the reported results, which was abstracted from REDCap to Microsoft Excel (2016; Microsoft Corp., Redmond, WA) on December 21, 2016, without respondent identifiers for final data enumeration. Basic descriptive statistical analyses were performed using SPSS statistical software (IBM Corp., Armonk, NY) on Windows 7. The study was performed at the Penn State College of Medicine, Hershey, PA.

Results

Of the 106 accredited otolaryngology residency training programs, 34 program directors responded, with a calculated survey response rate of 32%. All participating program directors filled out the entirety of the survey, save participants 9 and 13, who left questions 5 and 10 blank, respectively. Ninety-seven percent of program directors believed otolaryngology residents should be knowledgeable in the treatment and management of C1-INH-HAE. Of the surveyed programs, 38% have an allergy practice integrated into their otolaryngology department or division. Most program directors felt their residents were comfortable and very comfortable in the treatment and management of C1-INH-HAE, respectively (Fig. 1). In general, responses were mixed as to whether their training program provided enough education and exposure to C1-INH-HAE (Fig. 2). Residents were often trained in the management of C1-INH-HAE through in-person lectures and study materials with questions (Fig. 3). Eighteen percent of institutions have

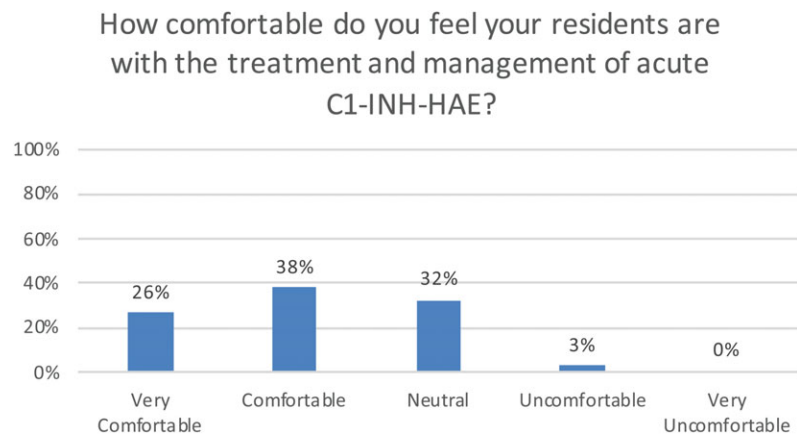


FIGURE 1. Question 3 from C1-INH-HAE survey. C1-INH-HAE = hereditary angioedema due to C1 inhibitor deficiency.

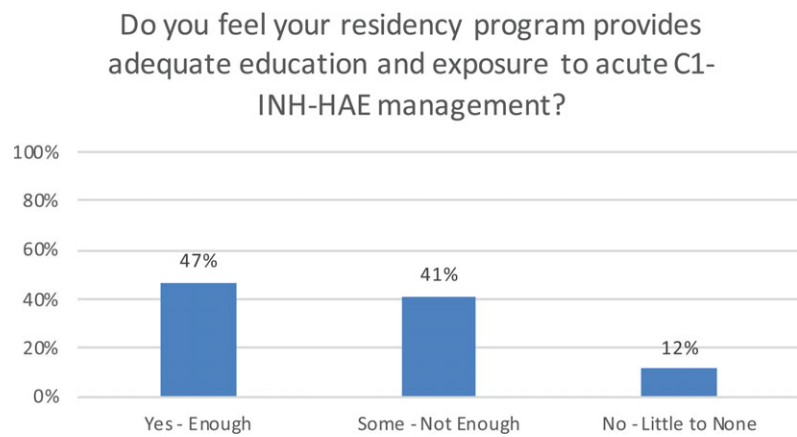


FIGURE 2. Question 4 from C1-INH-HAE survey. C1-INH-HAE = hereditary angioedema due to C1 inhibitor deficiency.

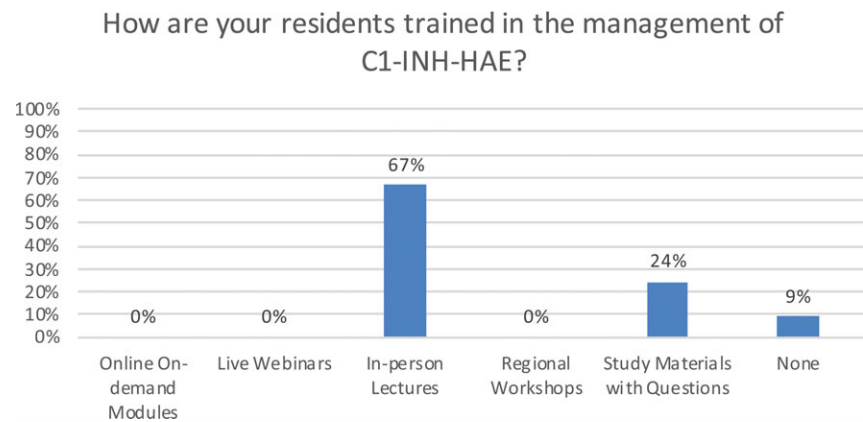


FIGURE 3. Question 5 from C1-INH-HAE survey. C1-INH-HAE = hereditary angioedema due to C1 inhibitor deficiency.

educational simulation activities involving C1-INH-HAE treatment and management. Typically, residents received education on acute C1-INH-HAE management as part of the otolaryngology residency curriculum (Fig. 4). But most otolaryngology training programs have no formal assessment of resident competency in caring for a patient with C1-INH-HAE (Fig. 5). Eighteen percent of programs have a protocol in place for C1-INH-HAE management. Over the

last 5 years, 45% reported their residents were exposed to 1 to 5 cases of C1-INH-HAE (Fig. 6). When residents were involved in the emergent care of C1-INH-HAE, respondents felt treatment could be provided independently by a junior resident (21%), with assistance of a senior resident (26%), with assistance of the attending otolaryngologist (18%), or in conjunction with another consulting service (35%).

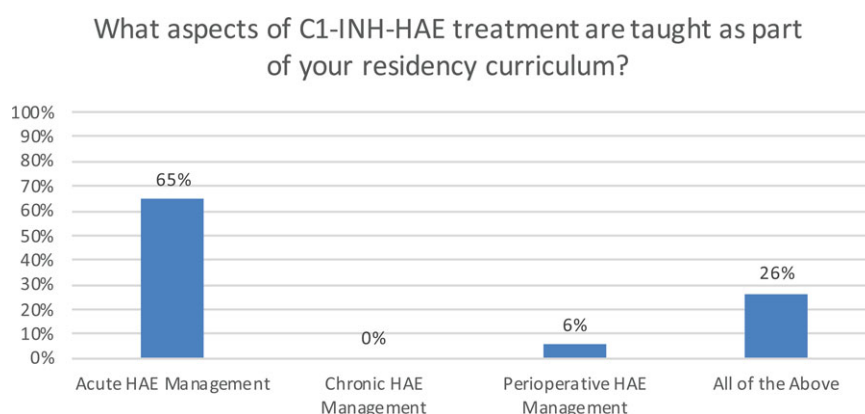


FIGURE 4. Question 7 from C1-INH-HAE survey. C1-INH-HAE = hereditary angioedema due to C1 inhibitor deficiency.

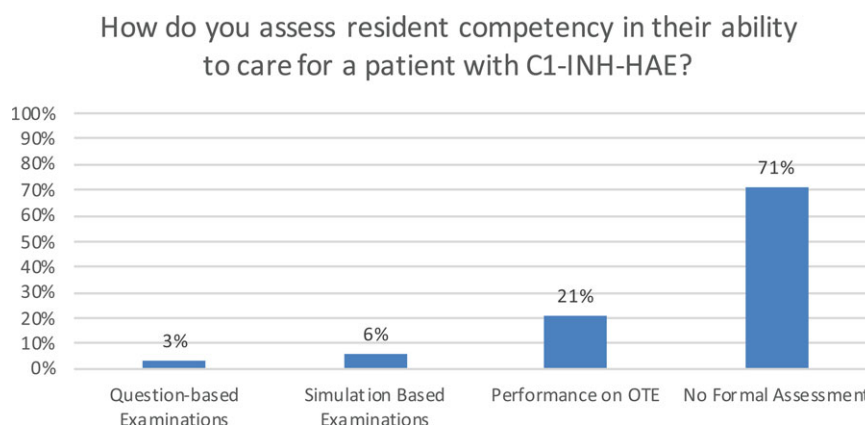


FIGURE 5. Question 8 from C1-INH-HAE survey. C1-INH-HAE = hereditary angioedema due to C1 inhibitor deficiency; OTE = Otolaryngology Training Examination.

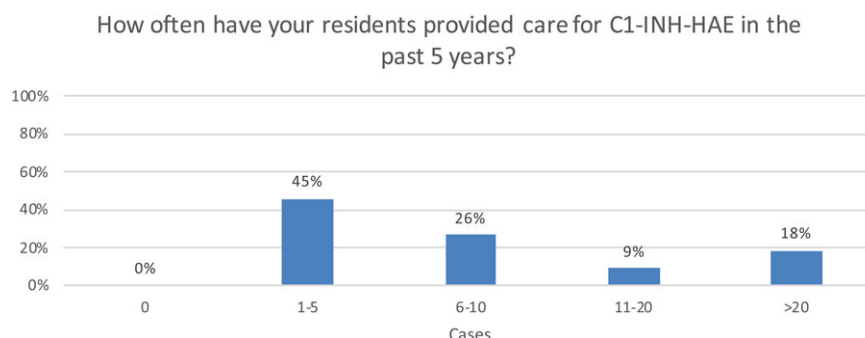


FIGURE 6. Question 10 from C1-INH-HAE survey. C1-INH-HAE = hereditary angioedema due to C1 inhibitor deficiency.

Discussion

Otolaryngologists are likely to be involved in the airway management of patients with acute episodes of C1-INH-HAE, and possibly during routine surgical procedures which can incite a C1-INH-HAE episode. The established consensus of high clinical suspicion and close monitoring is necessary for patients with symptoms and evidence of airway obstruction; a low threshold should remain for early airway intervention.¹³ Although acquired and idiopathic forms of angioedema may clinically be observed in

greater frequency, patients with C1-INH-HAE are at highest risk for recurrent episodes, making this subpopulation the most imperative to recognize, diagnose, and treat from a perioperative perspective. For these reasons, it is extremely important that otolaryngologists be thoroughly trained in the management of C1-INH-HAE.

This study is the first to offer insight into C1-INH-HAE education and training provided in United States otolaryngology-head and neck surgery residency programs. To our knowledge, no other training program across both medical and surgical subspecialties, has developed a

standardized protocol as well as an educational module with regards to formal C1-INH-HAE training. Program directors surveyed believe residents do need a strong knowledge base in the management of C1-INH-HAE, but less than half feel that their residents acquire the necessary experience with this emergent disease process or are otherwise trained well enough to feel comfortable in managing C1-INH-HAE. Historically, gaps have already been identified in other aspects of an otolaryngology resident's training including allergy medicine,¹⁴ emergent airway management,¹⁵ percutaneous tracheotomy,¹⁶ phonomicrosurgery,¹⁷ sleep medicine,¹⁸ and vascular anomalies.¹⁹

The 6-step model proposed by Kern et al.²⁰ can be used as a conceptual framework in the development of medical curriculum for C1-INH-HAE which complies with requirements and templates set forth by many accrediting bodies and links newly designed curricula to current health-care needs. This widely used systematic approach involves 6-steps: problem identification and general needs assessment, targeted needs assessment, goals and objectives, educational strategies, implementation, and evaluation and feedback.²⁰ Our study's findings define both general needs as well as targeted needs assessment in the management of C1-INH-HAE.

Analogous to other otolaryngology residency program studies, we propose adequate training in C1-INH-HAE could include simulation activity as well as a protocol for C1-INH-HAE management. Educational strategies that could be employed include both physical and virtual-reality simulators. Simulation has successfully been designed to enhance otolaryngology resident knowledge and demonstrate procedural skills in laryngeal, otologic, rhinologic, and robotic surgical procedures.²¹ Educational mannequins, which have previously been used for both pediatric²² and adult²³ endotracheal intubation, as well as nasopharyngolaryngoscopy,²⁴ could also be repurposed to create a clinical scenario simulating a patient with acute angioedema and pending airway compromise.

Given the social, psychological, and financial implications of C1-INH-HAE, effective perioperative management of C1-INH-HAE has significant potential to reduce and ideally prevent fatal C1-INH-HAE attacks. Like C1-INH-HAE, malignant hyperthermia is a rare pharmacogenetic disorder of skeletal muscle described in the anesthesia literature that presents as a hypermetabolic response to potent volatile anesthetic gases; the incidence of malignant hyperthermia reactions ranges from 1:10,000 to 1:250,000 anesthetics.²⁵ Much like the clinical manifestations of C1-INH-HAE, this syndrome is likely to be fatal if left untreated as it similarly presents in an emergent fashion. Professional skills in anesthesiology, much like in otolaryngology, are acquired during residency training while caring for patients. It remains impossible, however, to assure that trainees will gain uniform exposure to clinical challenges or have a chance to acquire and practice crisis management skills in a predictable fashion. Most residents

will encounter few of these critical events (ie, malignant hyperthermia and C1-INH-HAE) that they may face during a practice lifetime. As a result, simulation, as well as formalized education, can create crisis situations in a controlled atmosphere that permits review and practice without compromising patient risk. In a study by Holzman et al.,²⁶ 68 anesthesiologists and 4 nurse-anesthetists participated in an anesthesia crisis resource management training course. Scenarios included an overdose of inhalation anesthetic, oxygen source failure, cardiac arrest, malignant hyperthermia, tension pneumothorax, and complete power failure. The potential to practice anesthesia in a safely controlled exercise environment was rated highly by both junior and senior anesthesiologists (ie, 80% and 90%).²⁶ Although there is no definitive evidence for the effectiveness of simulator training in the management of C1-INH-HAE or malignant hyperthermia, simulation training should be embraced on both ethical and practical grounds.

Practice patterns regarding indications for prophylaxis remain limited. A retrospective study by Aygören-Pürsün et al.²⁷ in 2013 revealed 335 procedures (71 otolaryngologic) in 144 C1-INH-HAE patients did not receive preoperative prophylaxis from a total of 700 procedures in 247 C1-INH-HAE patients. The rate of documented angioedema without prophylaxis across all procedures was 6%; in 25% of procedures, the presence of perioperative angioedema could not be excluded, leading to a maximum potential risk of 31%.²⁷ In parallel, the Riedl et al.²⁸ 2009–2010 survey of 172 general U.S. physicians (not including otolaryngologists) reported that 16% and 20% of physicians do not prescribe short-term and long-term prophylaxis, respectively. Similarly, 9% of respondents did not recommend any treatment for patients with acute attacks. A follow-up survey by the same group in 2013 revealed that 57% of physicians do not prescribe long-term prophylaxis and 1% of physicians do not recommend any treatment for patients with acute attacks.²⁹ In this study, only 6% of respondents believed perioperative C1-INH-HAE management should be incorporated as part of the otolaryngology residency curriculum. Future goals and objectives would be to define what clinical knowledge is required of otolaryngology residents to be proficient in the preventative management of C1-INH-HAE.

With respect to implementation and development of a C1-INH-HAE protocol, this may be modeled after the Difficult Airway Response Team designed by Hillel and colleagues at Johns Hopkins in 2008. This multidisciplinary team consists of providers from anesthesiology, emergency medicine, and otolaryngology departments. Since the implementation of this protocol, 10 of 14 (71%) patients who presented with oropharyngeal/supraglottic angioedema were taken to the operating room for advanced airway management; 7 (70%) of these patients were exclusively managed by otolaryngologists using fiber-optic-guided nasotracheal intubation. In addition, case analysis revealed that head and neck surgeon involvement significantly decreased the number of necessary cricothyrotomies from

7 (0.7%) to 4 (0.2%) after implementation of the Difficult Airway Response Team.³⁰

As with most surveys, this study was not without limitations. The recorded response rate was 32%, which limits generalization of reported findings and potential implications; however, this is in line with the typical response rate for program director surveys of this type.^{31–33} Our results may also not reflect the overall education and practice patterns of C1-INH-HAE among residency programs nationwide. Collection of demographic data may have provided additional information about regional trends and the degree to which respondents reflect a broad cross-section of otolaryngology programs. This survey was also limited since results were solely derived from a single representative at a given residency program (ie, selection bias), rather than multiple sources, including otolaryngology residents or training program alumni. Program directors were selected for the survey because they were considered the most knowledgeable about their own program's resident curriculum and experience in C1-INH-HAE management. Nevertheless, we feel our survey

has at least shed some light into the imbalance between actual resident exposure to education about C1-INH-HAE as well as its perioperative management and the need for such training from the perspective of their program directors.

Conclusion

This article suggests that formal C1-INH-HAE education in many otolaryngology training programs is currently limited despite emphasis by program directors on resident knowledge in the management of this emergent condition. The results from this study will hopefully aid otolaryngology residency programs in assessing, modifying, and strengthening their training curricula. Further efforts could be directed toward the development of a standardized protocol in C1-INH-HAE management. This, in parallel, can provide a structured framework and treatment paradigm for otolaryngology residents and ancillary care providers alike, as these patients often require emergent evaluation in a variety of clinical settings. 

References

- Donati M. De medica historia mirabile. Mantua Osana. 1586;VII: Cap iii:304.
- Osler W. Hereditary angioneurotic edema. *Am J Med Sci*. 1888;95:362.
- US Hereditary Angioedema Association. Hereditary Angioedema. <http://www.haea.org>. Accessed March 5, 2018.
- Bhardwaj N, Craig TJ. Treatment of hereditary angioedema: a review. *Transfusion*. 2014;54:2989–2996.
- Gill P, Betschel SD. The clinical evaluation of angioedema. *Immunol Allergy Clin North Am*. 2017;37:449–466.
- Cicardi M, Aberer W, Banerji A, et al. Classification, diagnosis, and approach to treatment for angioedema: consensus report from the Hereditary Angioedema International Working Group. *Allergy*. 2014;69:602–616.
- Bork K, Ressel N. Sudden upper airway obstruction in patients with hereditary angioedema. *Transfus Apher Sci*. 2003;29:235–238.
- Agostoni A, Aygören-Pürsün E, Binkley KE, et al. Hereditary and acquired angioedema: problems and progress: proceedings of the third C1 esterase inhibitor deficiency workshop and beyond. *J Allergy Clin Immunol*. 2004;114:S51–S131.
- Zirkle M, Bhattacharyya N. Predictors of airway intervention in angioedema of the head and neck. *Otolaryngol Head Neck Surg*. 2000;123:240–245.
- Hoyer C, Hill MR, Kaminski ER. Angio-oedema: an overview of differential diagnosis and clinical management. *Contin Educ Anaesth Crit Care Pain*. 2012;12:307–311.
- Lin SY, Mabry RL. Allergy practice in the academic otolaryngology setting: results of a comprehensive survey. *Otolaryngol Head Neck Surg*. 2006;134:25–27.
- Bailey SE, Franzese C, Lin SY. Allergy education in otolaryngology residency: a survey of program directors and residents. *Int Forum Allergy Rhinol*. 2014;4:104–109.
- McCormick M, Folbe AJ, Lin HS, et al. Site involvement as a predictor of airway intervention in angioedema. *Laryngoscope*. 2011;121:262–266.
- Franzese CB. The current status of allergy training in otolaryngology residency programs. *Curr Opin Otolaryngol Head Neck Surg*. 2012;20:205–208.
- Andrews JD, Nocon CC, Small SM, et al. Emergency airway management: training and experience of chief residents in otolaryngology and anesthesiology. *Head Neck*. 2012;34:1720–1726.
- Goldenberg D, Park SS, Carr M. Percutaneous tracheotomy in otolaryngology-head and neck surgery residency training programs. *Laryngoscope*. 2009;119:289–292.
- Shah MD, Johns MM, Statham M, Klein AM. Assessment of phonosurgical training in otolaryngology residencies: a resident survey. *Laryngoscope*. 2013;123:1474–1477.
- Shen T, Shimahara E, Cheng J, Capasso R. Sleep medicine clinical and surgical training during otolaryngology residency: a national survey of otolaryngology residency programs. *Otolaryngol Head Neck Surg*. 2011;145:1043–1048.
- Chun R, Jabbour N, Balakrishnan K, et al. Education on, exposure to, and management of vascular anomalies during otolaryngology residency and pediatric otolaryngology fellowship. *JAMA Otolaryngol Head Neck Surg*. 2016;142:648–651.
- Kern DE, Thomas PA, Hughes MT. *Curriculum development for medical education: a six-step approach*. 2nd ed. Baltimore, MD: Johns Hopkins University Press; 2009.
- Javia L, Sardesai MG. Physical models and virtual reality simulators in otolaryngology. *Otolaryngol Clin North Am*. 2017;50:875–891.
- Hesselfeldt R, Kristensen MS, Rasmussen LS. Evaluation of the airway of the SimMan full-scale patient simulator. *Acta Anaesthesiol Scand*. 2005;49:1339–1345.
- Schebesta K, Hupfl M, Ringl H, et al. A comparison of paediatric airway anatomy with the Sim-Baby high-fidelity patient simulator. *Resuscitation*. 2011;82:468–472.
- Smith ME, Leung BC, Sharma R, Nazeer S, and McFerran DJ. A randomized controlled trial of nasolaryngoscopy training techniques. *Laryngoscope*. 2014;124:2034–2038.
- Rosenberg H, Pollock N, Schiemann A, Bulger T, Stowell K. Malignant hyperthermia: a review. *Orphanet J Rare Dis*. 2015;10:93.
- Holzman RS, Cooper JB, Gaba DM, et al. Anesthesia crisis resource management: real-life simulation training in operating room crises. *J Clin Anesth*. 1995;7:675–687.
- Aygören-Pürsün E, Martínez Saguer I, Kreuz W, Klingebiel T, Schwabe D. Risk of angioedema following invasive or surgical procedures in HAE type I and II—the natural history. *Allergy Eur J Allergy Clin Immunol*. 2013;68:1034–1039.
- Riedl M, Gower RG, Chvala CA. Current medical management of hereditary angioedema: results from a large survey of US physicians. *Ann Allergy Asthma Immunol*. 2011;106:316–322.
- Riedl MA, Banerji A, Gower R. Current medical management of hereditary angioedema: follow-up survey of US physicians. *J Allergy Clin Immunol Pract*. 2015;3:220–227.
- Hillel AT, Pandian V, Mark LJ, et al. A novel role for otolaryngologists in the multidisciplinary difficult airway response team. *Laryngoscope*. 2015;125:640–644.
- Kovatch KJ, Harvey RS, Prince MEP, Thorne MC. National trends in otolaryngology intern curricula following Accreditation Council for Graduate Medical Education changes. *Laryngoscope*. (in press). Epub 2017 Oct 9. <https://doi.org/10.1002/lary.26960>.
- Villwock JA, Hamill CS, Nicholas BD, Ryan JT. Otolaryngology residency program research resources and scholarly productivity. *Otolaryngol Head Neck Surg*. 2017;156:1119–1123.
- Villwock JA, Hamill CS, Ryan JT, Nicholas BD. The role of the away rotation in otolaryngology residency. *Otolaryngol Head Neck Surg*. 2017;156:1104–1107.

Appendix

Hereditary Angioedema (C1-INH-HAE) Education in Otolaryngology Residencies: Survey of Program Directors

1. In your opinion, should Otolaryngology residents be knowledgeable in the treatment and management of C1-INH-HAE?
 - a. Yes
 - b. No
2. Does your Otolaryngology program have an allergy practice?
 - a. Yes
 - b. No
3. How comfortable do you feel your residents are with the treatment and management of acute C1-INH-HAE?
 - a. Very Comfortable
 - b. Comfortable
 - c. Neutral
 - d. Uncomfortable
 - e. Very Uncomfortable
4. Do you feel your residency program provides adequate education and exposure to acute C1-INH-HAE management?
 - a. Yes - Enough
 - b. Some - Not Enough
 - c. No - Little to None
5. How are your residents trained in the management of C1-INH-HAE?
 - a. Online On-demand Modules
 - b. Live Webinars
 - c. In-person Lectures
 - d. Regional Workshops
 - e. Study Materials with Questions
 - f. None
6. Do you have simulation activity involving C1-INH-HAE treatment and management at your institution?
 - a. Yes
 - b. No
7. What aspects of C1-INH-HAE treatment are taught as part of your residency curriculum?
 - a. Acute C1-INH-HAE Management
 - b. Chronic C1-INH-HAE Management
 - c. Perioperative C1-INH-HAE Management
 - d. All of the Above
 - e. None
8. How do you assess resident competency in their ability to care for a patient with C1-INH-HAE?
 - a. Question-based Examinations
 - b. Simulation based Examinations
 - c. Performance on OTE
 - d. No Formal Assessment
9. Does your department or division have a protocol in place for the treatment and management of C1-INH-HAE?
 - a. Yes
 - b. No
10. How often have your residents provided care for C1-INH-HAE in the past 5 years?
 - a. 0
 - b. 1–5
 - c. 6–10
 - d. 11–20
 - e. >20
11. In situations where residents were involved in the emergent management of C1-INH-HAE, to what level were they able to manage the patient?
 - a. Independently
 - b. With Assistance of a Senior Resident
 - c. With Assistance of the Attending Otolaryngologist
 - d. In Conjunction with Another Consulting Service
 - e. Unable to Provide Care