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# A Systematic Approach to Airway Evaluations

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## Citation

J Zuckerman, C Moore. *A Systematic Approach to Airway Evaluations*. The Internet Journal of Otorhinolaryngology. 2008 Volume 8 Number 2.

## Abstract

**Objective:** To evaluate the baseline knowledge of primary care responders in their assessment and treatment of airway disease and to recommend a detailed protocol for airway evaluations based on objective deficiencies.

**Methods:** A five question survey was distributed to residents of all years of training in the emergency medicine department, internal medicine department, and pediatrics department at Emory University Hospital. The survey was anonymous and each question targeted a specific area in airway diagnosis and management. The average number of answers correct overall, within each group, within each year of training, and for each individual question were analyzed.

**Results:** A total of 64 residents (27 emergency medicine residents, 15 internal medicine residents, and 22 pediatrics residents) at Emory University Hospital participated in our study. The average percent of correct answers for all residents was 82% (84% for emergency medicine, 83% for internal medicine, and 79% for the pediatric residents). Average percent correct for each question for the overall group was: 95%, 98%, 63%, 66%, and 89% respectively. There was no statistical significance between groups of residents.

**Conclusion:** The results of the study indicate that residents were knowledgeable in definitions and classifications of airway obstruction. However, they lacked the necessary knowledge to initiate care and determine which types of scenarios qualify as emergent. Deficiencies were identified and used to create a recommended flow diagram for airway management in terms of history, physical exam, preliminary care, and ability to classify airway consults. Our survey demonstrated the need for resident education in airway evaluation.

Presented at the Society for Ear, Nose and Throat Advances in Children, San Francisco, CA, December, 2006

## INTRODUCTION

Management of the airway is the most critical responsibility of the otolaryngologist. A major limitation in the prompt and correct medical care for patients is the difficulty in coordinating the multiple services involved in an airway consultation. Often the patient presents to the emergency room physician or the primary care medical and pediatric service upon the onset of initial airway distress. A safe and controlled plan for airway disease workups requires participation and cooperation between the emergency room or triage center, the anesthesiologist, and the otolaryngologist.

Review of the literature reveals that the best preparation for airway emergencies is to provide a systematic protocol that can be easily followed by the initial responder. A recent study compared the effectiveness of computer based simulation and simulation training between attending

physicians and house staff officers. The results portrayed scenario simulation airway training in combination with computer based simulation were effective in training those ranging from intern to faculty attending in airway management [1,2]. Similar studies have indicated effectiveness in training anesthesiology residents as well as emergency room residents [3,4,5]. Zirkle et al recently demonstrated the effectiveness of simulation and protocol training in airway management for the otolaryngologist [6]. Studies show that preparation protocols and equipment anticipation are the keys to successful airway management [7].

The motivation for this project stems from the authors' experience at our county hospital in metropolitan Atlanta. At this facility, the otolaryngology service is asked to evaluate approximately five to ten airway consults per week consisting of about fifty percent pediatric patients. It was often difficult as the specialist consultant to determine the extent of the emergency based on the initial assessment portrayed by the primary responder. Many of the airway

emergencies were actually patients that were in no airway distress with presenting symptoms as mild as a cough or wheeze. Conversely, many patients that were not portrayed as emergent, quickly decompensated leaving the primary care physicians unprepared for potential airway disasters. The objective of this project was to assess the knowledge of primary responders in their ability to assess airway pathology and initiate treatment. Once areas of deficiency were recognized a detailed airway protocol was devised as a guideline for the primary responder. By following the previously shown effective methods of airway training, we attempt to offer a guideline for airway evaluation and diagnosis. Along with a detailed and step-by-step protocol for airway evaluations is a comprehensive diagram of the differential for airway obstruction in both the pediatric and adult patient. Our primary goal in conducting this study was to offer guidelines for the primary responder in their airway assessment and treatment thereby resulting in airway consultations being evaluated and treated in a systematic and safe manner.

### METHODS

To assess the competency of the primary responder in airway evaluations and diagnosis, a survey was distributed to residents in the pediatric department, internal medicine department, and emergency medicine department. The survey consisted of five questions each devoted to test a specific concept in airway management. The first question assessed the definition of stridor, while the second question assessed the differential diagnosis of stridor. The third question asked residents to identify which of the listed scenarios warranted an airway evaluation by the specialist. The fourth question attempted to test what aspects of the history, physical, and diagnostic work up by the primary responder were necessary prior to initiating a consult for an airway evaluation. The last question assessed the timing of involving the airway specialist in the management of a patient with a potential airway emergency.

### Figure 1

Figure 1: Airway Questionnaire. Questionnaire distributed to residents in the departments of Pediatrics, Internal Medicine, and Emergency Medicine

- 1) What is the definition of Stridor?
  - a. Low-pitched Inspiratory snoring
  - b. Rapid, turbulent flow of air through a narrowed segment of the respiratory tract, more specifically, the large airways
  - c. Turbulent flow of air through constricted small airways
  - d. Shortness of breath with evidence of retractions and cyanosis
- 2) Which of the following is not a probable cause of stridor?
  - a. Epiglottic swelling and Supraglottic swelling from an infectious cause
  - b. Inhalation injury to the larynx
  - c. Compressive laryngeal tumor
  - d. COPD exacerbation with pneumonia
- 3) Which of the following patients warrants an emergency airway evaluation?
  - a. Child with chronic cough and croup like symptoms
  - b. A patient with peritonsillar abscess
  - c. A patient with a CT scan showing "narrowing of the airway" in supine position
  - d. A patient with progressive worsening of tongue swelling, hardened floor of mouth and difficulty visualizing the oral pharynx
  - e. Both answer choice c and d
- 4) Which of the following information is not vital to obtain prior to making an airway consultation?
  - a. Chest xray
  - b. Oxygen saturations
  - c. Intubation history
  - d. Allergy history
- 5) A patient is complaining of shortness of breath, has noticeable retractions, and on careful examination has a large oral pharyngeal tumor that is bleeding. What should be done?
  - a. Call otolaryngology for instruction and wait for their arrival for initiation of care
  - b. Call anesthesia and wait for their arrival, call otolaryngology if there is difficulty during the intubation
  - c. Place patient on a monitored bed with oxygen, have heliox at the bedside, call anesthesia and have otolaryngology consulted
  - d. Place patient on oxygen and send for CT scan to evaluate the extent of the tumor, consult otolaryngology with the results

All surveys were anonymous with residents indicating their year of training and department affiliation. Results were scored as a percent correct for each question within each department and each year of training. Statistical analysis was performed comparing year of training, resident department, and specific question answered correctly among the overall group using an ANOVA statistical analysis.

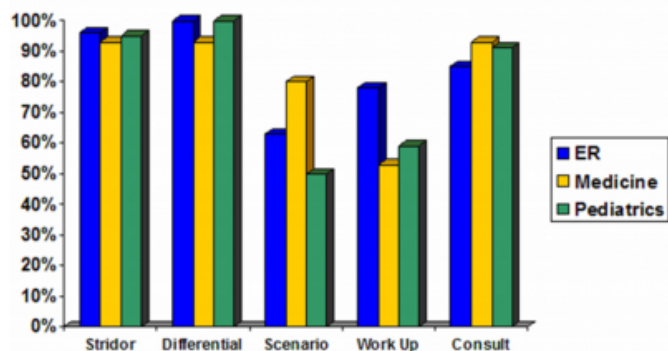
### RESULTS

There were 64 residents in total that participated in the survey. Fifteen residents were in the internal medicine department, twenty-seven residents were in the emergency medicine department, and twenty-two residents were in the pediatric medicine department. There were sixteen PGY 1 (program year 1) residents, twenty-two PGY 2 residents, and sixteen PGY 3 residents. The overall percent correct amongst all residents was 82%. Individually for each department, the overall percentage correct on the survey was 84% for emergency medicine residents, 83% for internal medicine residents, and 79% for pediatric residents. There was no statistical significance in percentage correct among residents in each group (p value 0.65).

**Figure 2**

Figure 2: Questionnaire percentage correct based on resident department

### Results by Resident Department

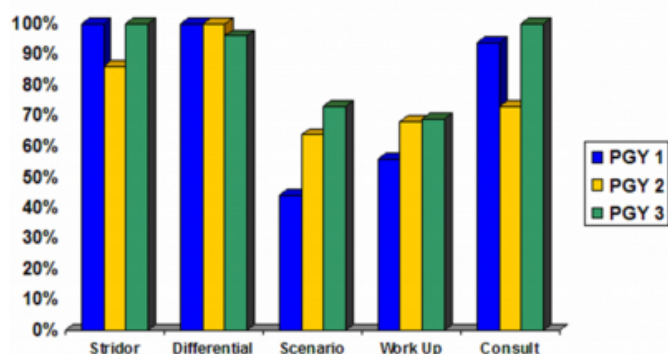


For each program year amongst the group as a collective whole, overall percentage correct for PGY 1 residents was 79%, overall percentage correct for PGY 2 residents was 79%, and overall percentage correct for PGY 3 residents was 86%. There was no statistical difference between program level groups (p value 0.17).

**Figure 3**

Figure 3: Questionnaire percentage correct based on program graduate year

### Results by Program Year



Analysis was also performed on percentage of participants that answered each question correctly. 95% of participants answered the question asking the definition of stridor correctly, as well as 98% of participants were able to correctly identify causes and differential diagnosis for stridor. In contrast, 63% of participants were able to answer questions about what scenario constitutes an airway emergency, and 66% of residents answered correctly what aspects of the history and physical were necessary on initial airway assessment. 89% of participants answered correctly

for the appropriate time frame to involve the otolaryngologist on consultation (p value 0.002).

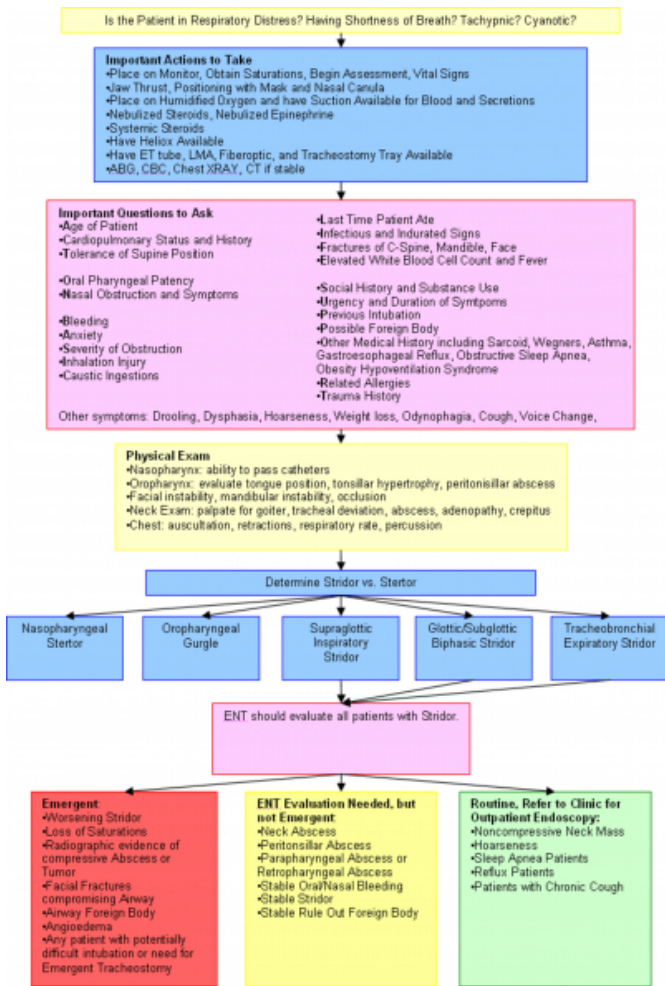
### DISCUSSION

Analysis of the survey results, revealed that there were certain areas of universal deficiencies amongst all three groups of residents in their work up of airway management. Our study demonstrated that there was no significant difference in baseline knowledge of airway management and diagnosis amongst residents in the department of internal medicine, pediatrics, and emergency medicine. There also was no demonstrable significant difference among residents in their first year of training versus their last year of training in their knowledge base of airway disease. Current residents in all three groups demonstrated marked competency in questions that pertained to the definition of stridor and possible differential diagnosis for causes of stridor in an airway work-up. Residents in all three groups were inconsistent in evaluating scenarios that constituted an airway emergency and what features of the history, physical, and diagnostic studies were important to obtain in these airway scenarios. The results indicate that residents have the baseline textbook knowledge of the definition of stridor and many of the possible disease presentations of airway distress, but lack the fundamental knowledge of how to approach, diagnosis, and manage such patients.

Recognizing these demonstrated areas of deficiency, a protocol was created to detail the necessary history and physical exam information necessary to be obtained from a primary responder in a potential airway evaluation.

Figure 4

Figure 4: Airway evaluation protocol guide for initial responders



The protocol was not developed to be a rigid protocol for primary care responders to follow in evaluation of airway disease, but rather a guide to more efficiently evaluate airway patients. The protocol begins by prompting the primary responder to decide the urgency and severity of their presenting situation by the status of their patient. It then details the important actions to take in chronological order to place the patient in an appropriate environment and amongst the appropriate equipment that can be available if the patient loses their airway or goes into distress emergently. By placing a patient exhibiting airway distress on a monitor in a setting where a tracheostomy tray and intubation materials are available, the primary care responder can begin to manage the airway and be more prepared when the airway consultant such as the anesthesiologist or otolaryngologist is called for assistance.

The importance of initial vital signs and oxygen saturations cannot be emphasized enough. It is crucial for the primary

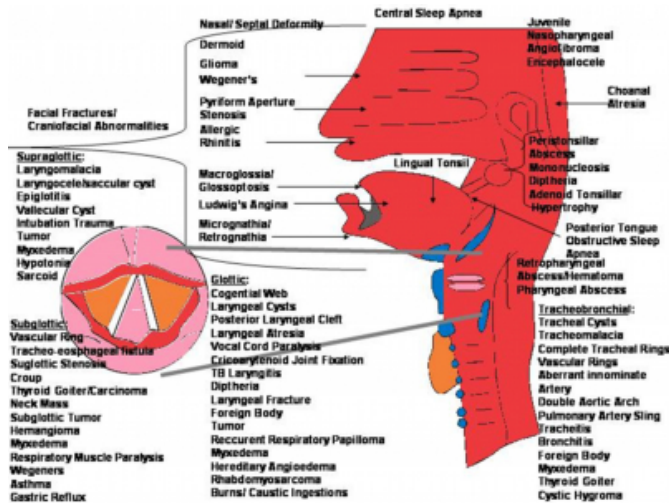
responder to obtain this information so that the consultant can gauge how quickly the patient is decompensating and decide if preparations need to be made to move the patient to an operating room setting or different environment. The protocol next offers a mnemonic that guides the primary responder as to what aspects of the history should be obtained for a patient presenting in airway distress. ““ACT ON BASIC LIFE SUPPORT”” details important aspects of the history that can better help differentiate the cause of the airway obstruction and aid the consultant in the appropriate course of action. Key initial actions in the physical exam are then detailed and suggested to the primary responder in an effort to have more information for the consultant to again help focus toward the appropriate diagnosis and management strategies in an efficient manner. The most important component of the protocol is to determine if the patient has true stridor and to classify this stridor as inspiratory, biphasic, or expiratory. It is the strong feeling of this otolaryngology department that any patient with stridor should be evaluated by an otolaryngologist. The last portion of the survey classifies many of the diagnoses that the otolaryngologist is called to assess and places them into categories of emergent, urgent, and outpatient evaluation. By providing examples of what constitutes an airway emergency, it is the intention of this protocol to allow for primary responders to quickly recognize such patients and call the otolaryngologist in a timely fashion to allow for management of such difficult and potential dangerous airway situations [7,8,9,10,11,12,13,14,15,16,17,18,19,20,21,22].

In conjunction with this airway evaluation protocol, a detailed diagram of the differential diagnosis for possible airway obstruction is classified by anatomic location.



**Figure 5**

Figure 5: Anatomic differential diagnosis of airway obstruction for adults and children



By having this differential diagnosis available, primary responders are able to use this diagram as a guide to help them formulate a possible diagnosis. The ability to have an early inclination about where the obstruction is or what may be the likely cause can better prepare the primary responder and the otolaryngologist for the necessary course of action for airway management. By detailing the essential aspects of the airway evaluation, a more efficient and effective work up and treatment for patients with airway disease and difficult airway presentations [23,24,25,26,27,28,29].

**FUTURE DIRECTIONS**

The airway evaluation protocol and differential diagnosis will be distributed to all emergency and primary care responders at our institution. At the time of its distribution, a ten minute lecture will be given to emphasize the essential teaching points in the protocol. A review of the differential diagnoses of airway obstruction will be given to the same group of residents in the pediatrics, internal medicine, and emergency medicine departments. The lecture will be compiled to specifically address the areas of deficiency based on the initial airway questionnaire. A post test will then be distributed and analyzed. A comparison of the initial pretest scores with post test scores will be evaluated to determine the effectiveness of the airway protocol. This baseline information will also be used to formulate subsequent lectures in educating primary responders on airway management and diagnoses.

By synchronizing the critical concerns of the primary responders with the expectations of the otolaryngologist, management of patients presenting with airway distress can

be handled in an appropriate and timely fashion. Airway competency is a key component of all physicians' fund of knowledge and the ability to be prepared for such medical situations can allow for successful management and treatment. By providing primary responders a detailed protocol for the initial management and diagnostic work up of airway evaluations, we have endeavored to further unify the responding team in airway management to provide safe and effective treatment for potential emergent situations.

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