

Do Anesthesia Residents perceive a Benefit from participating in Bedside Tracheostomies?

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Original Article

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Abstract

Background:

Airway management is a core competency in anesthesiology training and practice. Residents are taught how to evaluate patients and identify those who may have difficulty in securing their airway. The ASA has devised an algorithm on management of those difficult airways. The conservative methods are taught and practiced throughout training. However, the default last resort is obtaining an invasive airway. It is this potentially life-saving procedure that residents may graduate and have never performed clinically.

In our institution, the Anesthesiology Critical Care Division routinely performs percutaneous tracheostomies throughout the hospital. As residents began to inquire, they too were folded into this service to provide real hands on experience.

After 3 years we sought to determine if residents perceived this hands-on training to be a benefit.

Methods:

We devised a multi-question survey and distributed to our 131 residents. The purpose of the survey was to determine of those who participated in the tracheostomy service if they felt this was of benefit, which specialists they could look to should an invasive airway be needed and if they felt this exposure gave them greater confidence to perform an emergency invasive airway.

Results:

In unanimity, the residents all felt that this training was both beneficial and essential in their training. However, none of the residents felt this training had adequately prepared them to actually perform this procedure in an emergency.

Conclusions:

The residents felt this was an essential aspect of their anesthesiology training. However they did not feel they obtained invasive airway competence. We postulate the residents' relatively limited exposure may have been the cause.

While we do not know the impact of this training in residency on management of a future difficult airway, the residents uniformly felt this was vital in their clinical curriculum and should be universal.

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Financial support: No financial support

Manuscript

Introduction

Successful airway management lies as a core skill of anesthesia practice and is a fundamental to anesthesiology residency training. Along with supporting a patient's vital signs and providing an anesthetic capable of eliminating awareness and pain, airway management expertise is paramount in the profession.

Anesthesiologists master most of the practical skills employed for airway management in the operating rooms and within the hospital setting. We share some skill sets with other specialties including critical care, emergency medicine, general surgery, oral surgery and head and neck surgery. However, the likelihood of having the assistance of these other specialists immediately at hand is never certain. Furthermore, the need for airway management is not exclusive to the operating room. Throughout the hospital it is often solely in the hands of the anesthesiologist. Therefore as a specialty we train our residents to be able to plan and execute independently. The literature contains numerous articles about teaching airway skills and decision formulation. The substance of this education includes didactic formulation and planning for routine and complicated airway scenarios as well as the hands-on training of various techniques and tools. The American Society of Anesthesiologists (ASA) has acknowledged the importance of airway management and more specifically the management of the difficult airway by providing practice guidelines. The ASA guidelines for management of the difficult airway are essentially a decision tree of options when a difficult airway situation is encountered.¹

The difficult airway is a clinical situation in which a conventionally trained anesthesiologist experiences difficulty with face mask ventilation, difficulty with tracheal intubation or both. There are many factors that contribute to this situation. Some but not all difficult airways can be predicted. Several scores and measurements are standard assessment tools to identify potentially difficult airway patients. Based on the likelihood of an anticipated difficult airway, the ASA algorithm leads us to consider an awake intubation technique. However even with the most assiduous pre-operative examination anesthesiologists can easily find themselves with an unanticipated difficult airway. By following the ASA's difficult airway algorithm one has a clear avenue of well-considered options.

In the anesthetized patient with the unanticipated difficult airway the options include waking the patient, calling for assistance, trying different tubes and blades, repositioning the patient, trying an laryngeal mask airway (LMA®), Glidescope®, intubating stylet, bougie, retrograde intubation, blind nasal, etc1. As new devices and methods evolve the difficult airway algorithm has been modified. When a patient is found unconscious or apneic in the hospital awakening the patient to spontaneous breathing is not an option.

In this anesthesiology residency program and presumably every residency program there is concerted instruction in the techniques for airway management. Starting at the CA-I level we begin with the basics; bag-mask ventilation, direct laryngoscopy, Glidescope®, LMA® placement, supraglottic devices and fiber-optic devices. More advanced conservative training includes Bullard blades, Wu scopes, Shikani scopes, blind nasal, retrograde, bougie techniques

and light wand. However in the event the previous conservative options are not successful the algorithm directs us to obtain an emergency invasive airway. The question most encountered by the authors from trainees studying the ASA guidelines is, how does one obtain an invasive airway? Obtaining invasive airway access does not seem to be readily addressed in anesthesiology residency training. Many papers identify the need for, but failure for residents to be trained in invasive airway management.^{2,3,4,5,6,7}

A national survey assessed if and how anesthesiology training programs incorporate invasive airway management in their curricula.⁹ This group found that 88% of programs completing their survey did offer some education in surgical airway management in their curriculum with practice on mannequins (57%) being the most common form and the larger programs having a multimodal method that may include didactic teaching, cadaveric workshop or large animal laboratory or simulator.

At Jackson Memorial Hospital (JMH), the vast majority of tracheostomies are performed by the Critical Care Anesthesiology Medicine (ACCM) division. Initially the ACCM section had performed percutaneous tracheostomies only on its own patients, predominantly in the Cardiac Surgery Intensive Care Unit. The impetus to expand came at the request for service in other units; the Neurosurgical Intensive Care Unit, the Medical Intensive Care Unit, the Step Down Intensive Care Unit and lastly the Pediatric Intensive Care Unit. At first ACCM attending physicians and fellows took the consults and performed the procedures themselves. Anesthesiology residents on the Post Anesthesia Care Unit (PACU) took notice and asked to be included. They were incorporated into the bedside percutaneous tracheostomy service. This activity is now part of their curriculum.

At the start of their first year of anesthesia training (PGY-II/ CA-I) our residents undergo didactic, mannequin and porcine cadaveric instruction. During their PACU rotation they are incorporated into the tracheostomy service to see consults, discuss cases with attending physicians and perform the procedure. At bedside the ACCM fellow and resident(s) rotate procedural roles of being surgeon, co-surgeon and bronchoscopist/anesthesiologist. The ACCM/tracheostomy service attending is always present, usually scrubbed along with an additional anesthesiologist, monitoring the procedural aspect of the case.

Including every resident who rotates in the post anesthesia recovery unit and many of the residents in the intensive care unit (ICU) entails significant faculty effort in pre-procedure instruction and intense oversight. After three years of instituting formalized training to perform bedside tracheostomies it was our hypothesis that residents would find this beneficial at a certain threshold. We intended to continue this program if more than 80% answered positively on a survey. We further wanted to quantify how various dimension of their survey response differed by level of training and procedural role.

Methods

The faculty who instructed and performed percutaneous tracheostomy procedures devised a survey for trainees (see appendix). We constructed the survey for respondent variables including level of training, background and number of times and procedural roles each person played in

performing on the tracheostomy service. The central question intended to ascertain if trainees considered participation a valuable aspect of their training as anesthesiologists.

Procedural Roles: When trainees are not involved, two attendings perform tracheostomy with an ICU nurse at the bedside. One physician does bronchoscopy, monitors and orders sedation. The other attending is in the role of the surgeon. In our teaching tracheostomies one resident performs the bronchoscopy, one resident is in the role of first assist (i.e. learning the procedure), and one experienced resident or ACCM fellow is in the role of surgeon or instructor. The faculty member who is present throughout may order sedation, monitor, assist, and instruct in the bronchoscopy and tracheostomy procedures.

The information obtained in the survey included residents' previous background in performing tracheostomy, their current grasp of the American Society of Anesthesiologists (ASA) difficult airway algorithm, their preferred "rescue" method and their perception of who might be able to assist should an invasive tracheostomy/cricothyroidotomy be needed in the operating rooms, trauma bays, wards or off-site locations. Lastly, we asked if they found that this procedure gave them confidence in managing an invasive airway. We did not seek to directly gauge their ability to perform tracheostomy. The final survey was submitted to the institutional review board (IRB) of this institution and approved. Two days prior to a departmental grand rounds, an e-mail notice along with a copy of the survey went out to the house staff indicating we would be asking them to complete a survey before the start of the lecture. Participation in the survey was open to fellows, and residents in our program. Non-critical care fellows who had trained elsewhere were excluded.

Results

The JMH anesthesiology residency program consists of 131 trainees. The PGY-1 class is comprised of 19 physicians (53% were women, 47% men). The PGY II-IV classes consisted of 93 physicians (47% women, 53% men). Lastly, there were 17 post-graduate fellows (41% women, 59% men) in training. Initially we thought to eliminate one fellow in patient safety, three fellows in pain/regional training and one fellow in obstetrics; however, 6 post-graduate fellows out to the total of 17 were previously trainees in this residency. No fellows were eliminated from taking the survey, except as noted above.

Of the 120 residents we surveyed, 11% had claimed previous residency training of various types including surgical, ENT, pediatrics and medicine. We did inquire as to the type or extent of their training but because the aggregate number of previously trained residents was low we did not separately analyze their results separately. We also asked how many had performed a tracheostomy in the past either as a first assist or as the surgeon. While 20 (16%) of total respondents had some experience performing a tracheostomy their experience was gained as first assist during an internship year and never as primary surgeon.

The next consideration was to determine resident familiarity with the ASA difficult airway algorithm. We were particularly interested to see if residents knew that employing an invasive airway was part of the algorithm. We asked how many times was invasive/emergency invasive airway mentioned. The responses ranged from once to 5 times. Only 24% of survey respondents (n=27) answered correctly (three times is correct).

When asked which attending level physicians might be able to obtain an invasive airway should the need arise, survey participants rated several specialists on their ability to help obtain an airway, using a scale of 0 (no perceived ability) to 10 (expert ability). Only general surgery, otolaryngology (ENT), oral and maxillofacial surgery (OMFS) and pediatric surgery scored at a level of 5 or higher.

Of the 120 eligible respondents, 92 participated in the tracheostomy service. The remaining residents had not rotated in the ICU or PACU at our main teaching hospital (JMH). The distribution of procedural roles was as follows; 12 did the bronchoscopy only, 24 did first assist only, 5 were in the role of surgeon only, 27 did bronchoscopy and first assist, 14 did bronchoscopy and surgeon, 2 did first assist and surgeon only; 8 did all three positions, bronchoscopy, first assist and surgeon. We hypothesized specifically that the residents who only performed the bronchoscopy would assess their satisfaction and perception of utility at a lower level while expecting the reverse for trainees who participated in either the first assist or surgeon roles.

Ultimately 92 participants included in this anonymous survey. The entirety of the survey appears in the appendix; however, the essential questions and associated responses were:

1. *Do you think your participation in the tracheostomy service was a positive experience in your training?* All 92 participants in the tracheostomy service answered yes.
2. *Do you think participation increased your skill set?* All participants in the tracheostomy service answered yes.
3. *Do you think you could obtain an invasive airway in an emergency situation following your participation in the percutaneous tracheostomy service?* 43% (40/92) respondents answered 'yes'. The critical care fellows answered 100% (3/3) that they could obtain an invasive airway following this training. The fellows' experience far exceeded that of any resident. Initially the fellows were the first assist and then after a month of fellowship, they took the role of surgeon teaching and instructing the juniors in the procedure. The remaining 37 residents who answered "yes", that they think they could obtain an invasive airway all had done 4 or more procedures as first assist. It would seem this may be the number after which trainees start to recall the various steps and feel.
4. *Do you think hands-on training in obtaining invasive airway should be incorporated into anesthesiology residency training?* All 120 survey participants, even those who had not participated in the service answered yes.

Questions #1-#3 for the remaining 28 residents were not included in the survey as non-contributory.

There are some obvious limitations of this study. First, we did not break out the results based on post-graduate year level. The reason for this was that some seniors may have had fewer experiences in the tracheostomy service than some juniors. Second, we did not break out responses based on roles served at the bedside or previous tracheostomy experience. Since there

was uniform agreement about the value of this service by participants who had done at least four procedures, we believe it would serve no benefit. Third, we acknowledge that this is a study from a single institution and results may not necessarily apply in other settings. Fourth, we only permitted yes or no answers without the ability to qualify answers or provide other feedback. Lastly, we did not compare the value of bedside participation versus simulation as this was not the purpose of the paper.

Discussion

In this report we describe trainees' assessments of a novel invasive airway training module conducted in a large anesthesiology residency teaching program at a single institution. All module participants agreed that they had a positive experience, that their skills had increased and that such training should be incorporated into anesthesiology residency training curricula, while less than half felt confident that they would be able to secure an airway invasively under emergent conditions.

From our survey we see trainees coming to anesthesiology residency had relatively little meaningful independent invasive airway experience. While it comes as no surprise that anesthesia residents are not routinely exposed to invasive airway training, this appears paradoxical considering that airway management can be a final lifesaving technique entrusted to the anesthesiologist. At our hospital, as is the case in many training institutions, faculty and senior resident surgeons of various specialties are relatively available. Hence anesthesiologists frequently take comfort that these colleagues can back them up in emergent situations when conventional airway techniques have failed. Yet Riley et al. report that a preponderance of surgeons felt unprepared to step into such a situation.¹⁰ From our own survey it is clear the anesthesiology trainees' confidence rests predominantly in the hands of general, trauma, ENT and oral surgeons. The corollary of this finding would imply that availability of expert assistance cannot be assumed in clinical settings where such specialists are unavailable.

If one is to assume anesthesiologists should be able to perform the options in the ASA difficult airway algorithm, then invasive airway skills need to be taught. Surveys of training institutions indicate that the majority of accredited anesthesiology training programs that teach invasive airway procedures do so with mannequins, cadavers and lectures.⁹ It is difficult to determine if this type of training is sufficient although residents who were trained in percutaneous cricothyrotomy and retrograde intubation using preserved cadavers had improved confidence.² We concede that our survey did not directly assess our trainees' invasive airway management ability in actual clinical situations. At the same time, we find no prior reports in which trainees were assessed for such a training outcome. One group compared skills development of trainees using a model compared to a simulator and found no difference.³

We queried module participants about their perceived ability to independently undertake an emergency invasive airway technique after actually performing it in a controlled, supervised environment with trained faculty. The 37 residents and 3 fellows (40/92) who answered yes represents those who had done the most procedures. The fellows did nearly all procedures as surgeons after their initial training and all of the 37 residents who answered yes, did at least 4

procedures as first assistant. Perhaps the reluctance of those who participated but answered no, drove home the weight and complexity of invasive airway and that it takes considerably more experience and training to attain mastery. We speculate that the 52 trainees who participated in the module but answered no with regard to their ability to obtain emergency invasive airway might have done so because they were intimately exposed to the procedure and saw the how easily an error could be made. This facet of training experiences bears further investigation; as well, further work should determine how many procedural experiences are required for trainees to develop the necessary self confidence for performing an invasive airway technique and how many procedures should be required for competence in performing elective tracheostomy. At this institution hands-on training is now established as part of the clinical curriculum. While trainees may or may not always be the best judge of their training needs our residents clearly felt this aspect of difficult airway training was an essential aspect of anesthesiology residency education and should be incorporated in to training programs at large.

Another issue is the potential addition of invasive airway skills to the array of educational milestones in anesthesiology training and certification. The authors suggest further studies to explore the need for this type of training. Not all programs will have the capability and clinical resources required to teach these skills reliably. It would be impractical to implement a requirement that most training programs cannot offer. The CCM faculty at this institution initially started performing these procedures on their own Cardiac Surgery Intensive Care unit patients. In trying to decompress a busy OR schedule and looking for opportunities to keep costs down we volunteered our services to the Neurosurgical ICU, Medical ICU and the long term ventilator dependent wards. The hospital administration was supportive in part because a bedside percutaneous tracheostomy service has substantive financial benefits to the hospital.¹¹

In summary, airway training is critical for anesthesiology practice. The more we increase service to areas without the traditional surgical support the more imperative it is that our trainees are exposed to and confident to handle all airways and situations. Especially if training modules such as ours can be shown to improve airway-related morbidity and mortality, anesthesiology training programs may need to look more aggressively for opportunities to teach these skills so that graduates are equipped with all the necessary tools for safe and successful practice.

Acknowledgements, Disclaimers

Acknowledgements: None

Sources of funding: None.

Financial disclosures and potential conflicts of interest: None.

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Appendix 1– Actual Trainee Questionnaire

What is your training level?

PGY-1 PGY-2 PGY-3 PGY-4 PGY-5

Did you do a previous residency before this current training?

YES NO

If yes, what type of training and for how long?

Have you ever been surgeon or first-assist for a tracheostomy?

Yes, surgeon Yes, first assist No

Have you ever performed a retro-grade wire intubation technique electively?

Yes No

Have you ever performed a retro-grade wire intubation technique emergently?

Yes No

If you can not intubate or ventilate, what method is your fall back?

LMA Video Laryngoscope (Glidescope, McGrath) FiberOptic Lightwand
other? _____

How familiar are you with the ASA Practice Guidelines for Management of the Difficult Airway ?

0 (have no knowledge) 1 2 3 4 5(have it memorized)

How many places is “invasive/emergency invasive airway access” mentioned on the ASA Practice Guidelines for Management of the Difficult Airway?

0 1 2 3 4 5

On a scale of 0-10 please assign your impression of the following attending level non-anesthesiologists’ ability to perform invasive airway (0 = not capable of any assistance, 10 = could step in and perform emergency cric/trach with ease)

Gen’l /trauma Surgeon 0 1 2 3 4 5 6 7 8 9 10

ENT Surgeon 0 1 2 3 4 5 6 7 8 9 10

Neurosurgeon 0 1 2 3 4 5 6 7 8 9 10

Pedi surgeon 0 1 2 3 4 5 6 7 8 9 10

Urologist 0 1 2 3 4 5 6 7 8 9 10

| | | | | | | | | | | | |
|---------------|---|---|---|---|---|---|---|---|---|---|----|
| Gyn/Ob | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Oral Surgeon | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Orthopedist | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Radiologist | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Podiatrist | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Radiation Onc | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Dentist | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |
| Psychiatrist | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Did you know clinical (on patients) percutaneous airway training was available at UM before applying for residency?

YES NO

If yes, did this have any bearing on your NRMP ranking of our program?

YES NO

Do you recall any other anesthesiology residency program providing this training ?

YES NO

Did you ever do a tracheostomy/cricothyrotomy on mannequin or cadaver?

YES NO

Have you done performed percutaneous tracheostomy with the Tracheostomy Service (Dr. Quinn/Dr. Silverman)?

YES NO, do you feel you want to do this? YES NO You are done with the survey.

If yes,

| | |
|--------------------------|-----------------------|
| _____ as bronchoscopist? | How many times? _____ |
| _____ as first assist? | How many times? _____ |
| _____ as surgeon? | How many times? _____ |

Did you have a positive experience ? (went well, felt you got good instruction)

YES NO

Do you feel this experience was of benefit to your skill set as an anesthesiologist?

YES NO

Having done the procedure, do you feel that should it ever be clinically necessary you could obtain an invasive airway?

YES NO

Do you think this experience should be an essential component of anesthesiology training?

YES NO

Figure 1 –Anesthesiology resident impression of specialist ability to obtain a surgical airway.

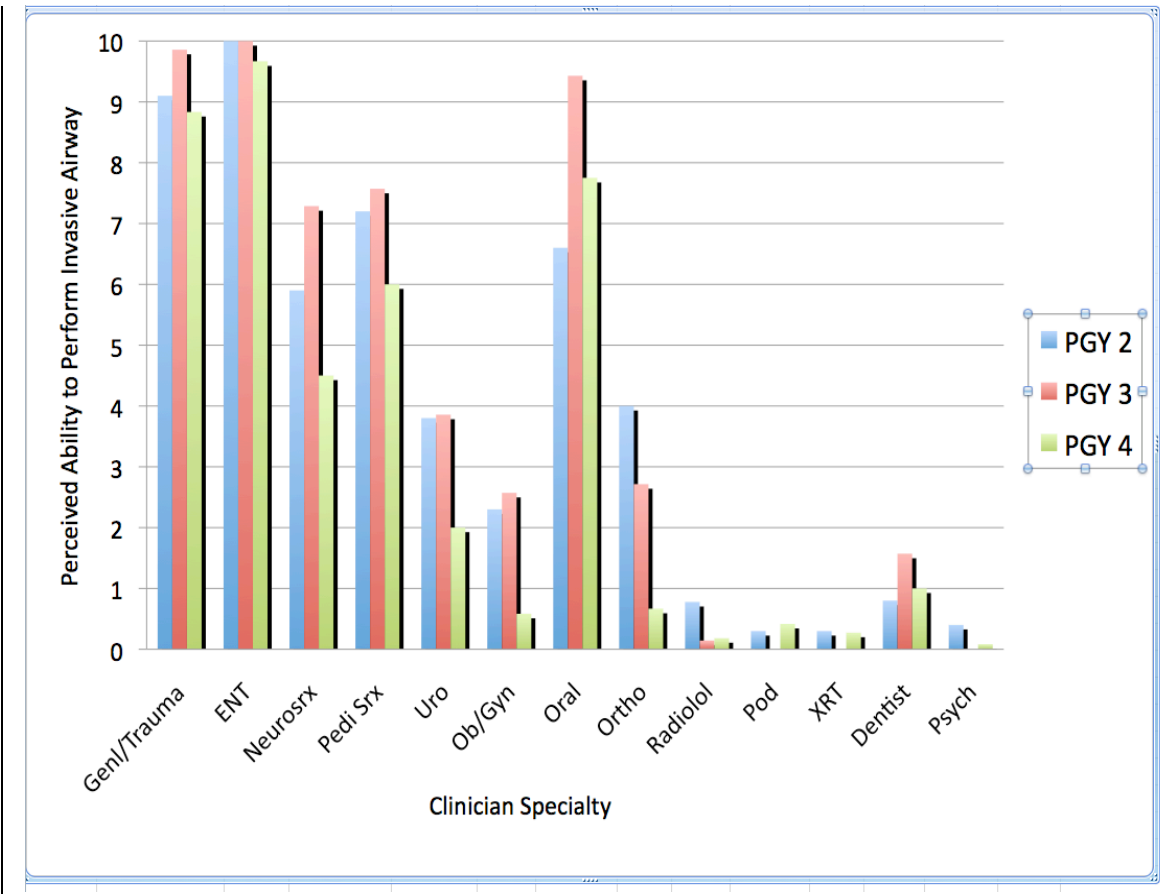


Figure 2 – Procedural roles of residents who participated in the tracheostomy service

