

# A Multifaceted Inter-Specialty Approach to Teaching Advanced Airway Management

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## Abstract

**Objective:** Our aim was to establish a multifaceted interspecialty advanced airway training program for residents using multiple teaching methods, including lectures, animal models, and simulation scenarios. **Methods:** 41 residents in Otolaryngology, General Surgery, Anesthesia, and Emergency rotated through seven stations, each representing a teaching objective in airway management. Residents completed a pre and post questionnaire about their level of skill and knowledge of airway management. **Results:** The mean pre-post difference calculated showed a self-perceived improvement in skill and knowledge in all topics covered ( $p < .05$ ), namely cricothyroidotomy, emergency tracheostomy, controlled open tracheostomy, fiberoptic bronchoscopic intubation, laryngoscopic video-assisted intubation and management of the pediatric airway. The majority rated the course highly in terms of usefulness and all would recommend the course to their colleagues. **Conclusion:** The multifaceted interspecialty course was well received by all residents. Self-perceived improvement was found for all topics covered. The interspecialty aspect allowed improvement in communication and professionalism.

## INTRODUCTION

For decades, medical education has relied on the apprenticeship model to train new generations of physicians. Thus, the training of residents is heavily based on the clinical encounters they face over their residency, somewhat dependent on the patient demographics and areas of expertise of their institution and to a large extent, pure chance. The apprenticeship model has obvious limitations such as the lack of homogeneity amongst centers, the balance between the risks to patient care and trainee education and the restriction of experience to available clinical cases. As Kneebone puts it, "learning is an opportunistic process, grafted onto clinical practice." [1]

There has been an evolution in available teaching modalities with the emergence of novel technological tools. Indeed, educators today rely on various resources with a shift from pure didactic sessions to the use of animal models, simulators and virtual reality. The use of a multifaceted teaching approach was validated by Davis and colleagues who published a systematic review, recognizing this approach for teaching physicians as an efficient manner of education. [2]

The apprenticeship model of training is further limited in airway management due to the high risk nature of certain

procedures. Also, it is difficult to justify a difficult airway as a hands-on teaching experience and there is often early staff intervention during such cases. However, it is imperative that residents in many specialties become proficient in airway management as it is an aspect of medicine relevant to many disciplines in medicine. [3] Although individual specialties require different levels of competency, airway management is nonetheless required in surgery, emergency medicine, otolaryngology, anaesthesia and other disciplines. Despite the common clinical skills, thus far, airway management skills have been taught to each discipline individually. Training individualized to each specialty has some limitations, including, but not restricted to, the lack of interprofessional communication and the absence of competency sharing.

Our aim was to establish a multifaceted interspecialty training program for residents in multiple specialties to teach airway management skills using didactic lectures, animal models, case-based simulations, as well as a state-of-the-art simulation man. We hypothesized that as airway management is a skill common to many fields of medicine, a course designed to train residents of many disciplines would not only be efficient, but also appreciated and well received by both trainees and staff.

### METHODS

A full-day training session in advanced airway management was organized for residents at McGill University. There were a total of 41 residents, with 6 training in otolaryngology, 13 in general surgery, 11 in anaesthesia, 10 in emergency medicine and 1 in sports medicine. There were 23 R1s, 14 R2s and 3 R3s. The course, which was developed by anaesthesiologists, otolaryngologists and experts in medical simulation, took place at the McGill Simulation Center, located in Montreal, Canada. The objective was to enhance the psychomotor skills and advanced airway management knowledge of the trainees, as well as to develop communication skills and professionalism amongst the specialties.

The day consisted of two lectures on airway management, as well as 7 stations with case-based simulations, each representing a major teaching objective in advanced airway management. The stations were monitored by physicians from the departments of Otolaryngology, Anesthesiology and General surgery. Each station consisted of a small group didactic lecture, a demonstration by a physician, time for hands on practice and a case scenario. The themes for the stations were the anticipated difficult airway, the surgical airway, airway trauma, the pediatric airway, the use of fiberoptic scopes and case scenarios. All the case simulations were followed by a short debriefing session in which the staff supervisor discussed the strengths and weaknesses of the trainees' performance.

Residents completed a questionnaire (5 point Likert-type scale), at the beginning and at the end of the day for comparison. Trainees were asked about their level of skill and knowledge with regards to multiple airway management techniques. The pre-test questionnaire also included a separate section asking trainees to check off a list of airway management techniques that they had simulation training on in the past, techniques that they had already attempted in clinical situations, techniques that they anticipated to be used in their career and techniques in which they felt they need simulation training.

All trainees responses were anonymous and confidential. The pre- and post-training questionnaires of each participant were analysed together and the numerical change in response to the questions was noted. A mean difference for each question was then calculated for the whole cohort of trainees as well as each individual specialty. The Wilcoxon signed-rank test was used to determine whether the degree of the

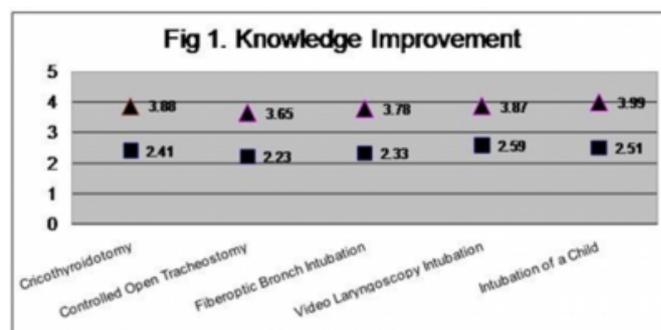
observed difference was statistically significant. Two general surgery residents were excluded from the analysis because they did not complete a pre-test questionnaire.

### RESULTS

The mean difference calculated for all residents showed an improvement in all topics covered, namely cricothyroidotomy skill, 1.97; cricothyroidotomy knowledge, 1.47; emergency tracheostomy skill, 2.05; emergency tracheostomy knowledge, 1.64 ; controlled open tracheostomy skill, 1.96; controlled open tracheostomy knowledge, 1.42; fiberoptic bronchoscopic intubation skill, 1.68; fiberoptic bronchoscopic intubation knowledge, 1.45 ; laryngoscopic video-assisted intubation skill, 1.56; laryngoscopic video-assisted intubation knowledge, 1.28; management of the pediatric airway skill, 1.73; management of the pediatric airway knowledge, 1.47. The results were all statistically significant ( $p < 0.05$ ). Improvement in knowledge and skill of airway management are presented in figures 1 and 2 respectively. The results for each individual discipline are presented separately. The results for the sports medicine 3<sup>rd</sup> year resident are not included as he was the only representative from the specialty. (see table 1)

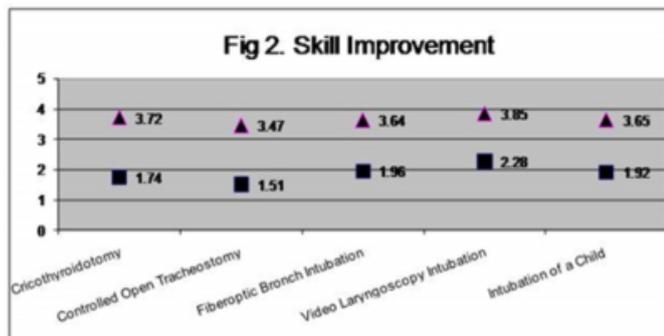
**Figure 1**

Fig 1 Self perceived improvement in airway management knowledge between pre-training [ ] and post-training [ ] questionnaires



**Figure 2**

Fig. 2 Self perceived improvement in airway management skills between pre-training [ ] and post-training [ ] questionnaires



**Figure 3**

Table 1 Self Perceived improvement in airway management skills and knowledge for each specialty. Numbers indicate mean difference between pre and post-training questionnaires. (p value < 0.05, unless otherwise indicated)

	Mean Difference			
	ENT	General Surgery	Anaesthesia	Emergency medicine
cricothyroidotomy skill	1.67 <i>p</i> = 0.0625	2.36	2.09	1.7
cricothyroidotomy knowledge	1.67 <i>p</i> = 0.0625	1.91	1.41	1.3
emergency tracheostomy skill	1.5	2.45	2.18	1.9
emergency tracheostomy knowledge	1.67	1.73	1.73	1.5
controlled open tracheostomy skill	1 <i>p</i> = 0.125	2.64	2.14	1.8
controlled open tracheostomy knowledge	1 <i>p</i> = 0.125	1.82	1.32	1.5
fiberoptic bronchoscopic intubation skill	1.33 <i>p</i> = 0.0625	2.45	1.05	1.8
fiberoptic bronchoscopic intubation knowledge	1.5 <i>p</i> = 0.0625	2.09	0.86 <i>p</i> = 0.07422	1.4
laryngoscopic video-assisted intubation skill	1.83 <i>p</i> = 0.0625	2.55	0.55 <i>p</i> = 0.07812	1.4
laryngoscopic video-assisted intubation knowledge	1.67 <i>p</i> = 0.0625	2.18	0.55 <i>p</i> = 0.1289	0.8 <i>p</i> = 0.05469
management of the pediatric airway skill	2	2.55	1.32	1.2
management of the pediatric airway knowledge	2.17	2.09	1.05	0.7

Table 2 presents the topics in which the residents had already received simulation training, techniques that they had already attempted in clinical situations, techniques that they anticipated to be used in their career and techniques in which they felt they need simulation training. The majority of trainees (95% and 100%) rated the course at least a 4 on a 5 point Likert scale in terms of usefulness and if they would recommend the course to their colleagues, respectively. The trainees' response for who should participate in the course and how often the course should be taken is represented in figures 3 and 4, respectively.

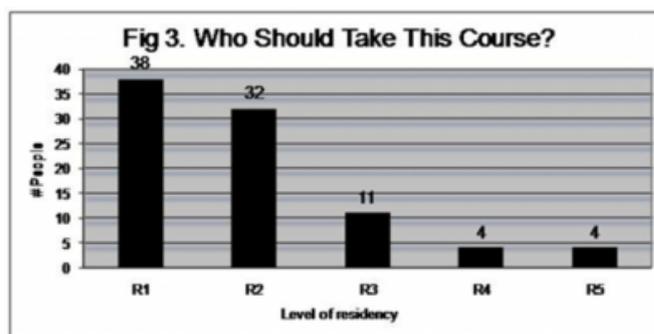
**Figure 4**

Table 2 Trainees's response to questions: Which technique have you already had simulation training? (column 1), Which technique have you previously performed in real life situations? (column 2), Which techniques do you anticipate using in your practice? (column 3), Which techniques do you feel you need more training? (column 4)

	Already had simulation training	Performed in real life situation	Anticipate need in practice	Need more training in future
Cricothyroidotomy	22	2	35	33
Emergency trach	4	4	24	32
Controlled open trach	3	10	16	22
Intubation peds	17	16	33	24
Fiberoptic bronch intubation	6	17	27	25
Video laryngoscopy intubation	7	14	25	18
Stylet intubation	21	28	32	18
Bougie intubation	16	16	27	22
Light wand intubation	6	8	19	17
Jet assisted intubation	3	7	23	20
LMA insertion	22	27	29	13
Coordinating intubation child	6	12	31	23
Coordination intubation anticipated difficult airway	9	15	34	29

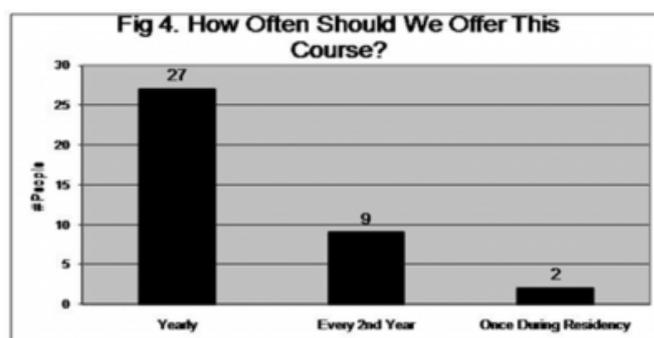
**Figure 5**

Fig 3 Trainees's response of who should take the airway management course.



**Figure 6**

Fig.4 Trainees' reponse to how often the course should be taken.



The overall feedback from the trainees was that the course was not only a great way to learn difficult technical skills, but also an ideal manner to share expertise between specialties. They truly appreciated the input from physicians from multiple disciplines and enjoyed working within an

interdisciplinary group.

### **DISCUSSION**

Our course offered a multifaceted approach to the teaching of advanced airway management. We used both high and low fidelity teaching methods, such as didactic lectures, small group discussions, animal models, case based simulation on mannequins and a Simulation man to enhance the skill and knowledge of our trainees in airway management. The use of various different modalities allowed the residents to develop their skills in a progressive manner within a comfortable and monitored setting. Our results are consistent with the findings of Davis and colleagues who reported that a multifaceted approach was an effective manner of continued medical education.[2]

Simulation training is a tool that has been used with immense success in professions such as aviation, military and commercial, nuclear power plant operators, ship captains and military weapon operators. For example, Gaba and colleagues recognized the need for simulation in the training of clinicians in emergency situations many years ago and developed a training course termed anesthesia crisis resource management (ACRM) based on the training program used in aviation.[4] This paradigm has extended to other disciplines such as emergency medicine, trauma, intensive care, cardiac arrest response and radiology. [5] Zirkle and colleagues recently developed a similar training program for otolaryngology residents only for the management of airway emergencies.[6] Simulation training is a promising modality to complement the apprenticeship model in resident training. In recent sessions, trainees have for the most part been very receptive to simulation training [6-11]. Our results are consistent with previous studies. In fact, the majority of our trainees found the course useful and would recommend it to their colleagues. They really appreciated the interspecialty aspect of the course and responded well to the multifaceted teaching modalities.

We analysed our data both for the residents as a whole group and according to specialty. Both scenarios showed a statistically significant improvement in self evaluation of skills and knowledge of residents in the majority of topics covered. Amongst all the disciplines, the cohort of general surgery residents showed the greatest improvement of all the topics, except for the management of the pediatric airway. In the latter case, the ENT group reported a larger increase in knowledge.

Although our results are based on subjective improvement of

residents, other authors have also reported positive self-evaluations of residents after simulation training, stating a better performance in clinical situations.[7] Moreover, in surgery and anaesthesia, simulation training have translated in better performance in real life situations.[12-14] However, it is difficult to assess the impact of airway management simulation training on patient mortality in an objective manner due to the relative low frequency of high risk and unusual events. Most research in airway management is based on trainee questionnaires and self evaluations, thus causing a large amount of subjectivity in the assessment of its' clinical impact.

Furthermore, management of a difficult airway is one of the most challenging skills to develop for healthcare professionals.[15] Studies have recognized human error as an important contributor in the etiology of critical accidents in anasesthesia. [7] Cook reports that although there has been a decrease in opportunities for trainees to practice intubation, the amount of intubations that occur during high risk moments has not diminished.[16] Thus, trainees are likely to face a situation in which they feel untrained to manage the emergency. In fact, a disproportionate number of airway emergencies occur out of regular working hours, at a time when trainees are the first responders on-call.[16]

Simulation training would also allow residents to be more efficient in their clinical practice, thus saving time in places like the OR, where time is limited and expensive[15], as well as saving time for staff physicians who don't need to train them in skills they already learnt through simulation. In addition, authors have shown that technical skills deteriorate if not regularly practiced. [1, 17] Similarly, residents have suggested that simulation training be repeated regularly. [3, 7, 18] In our study, a large portion of the trainees felt that the course should be repeated yearly or to a minimum, every two years.

Airway management is an essential proficiency that is utilized in various specialties such as anaesthesia, otolaryngology, emergency medicine, surgery and many others. Moreover, in many emergency situations, professionals of various specialties are required to work together. The presence of multiple professionals with different background training has the potential to create differing opinions in management. Enhancement of team behaviour skills and coordination has been recognized as a vital element in patient care safety and well-being.[18] A recent editorial stated that "simulator training of clinical teams, both single and multi-disciplinary, becomes

increasingly important, as clinical failures most frequently result from poor team interaction.”[19] Thus, we believe that it is necessary that airway training sessions be multidisciplinary in order to establish a certain homogeneity in training not available through the apprenticeship model. During our session, residents in all disciplines emphasized the benefit of having staff from different specialties (Otolaryngology, Anesthesiology and General Surgery) involved in the teaching. An interspecialty course not only improves communication, but also professionalism amongst different disciplines. To our knowledge, our study is the first to present a multidisciplinary training session in airway management, involving residents from multiple specialties involved in airway management.

### **CONCLUSION**

Our hypothesis was correct in terms of the benefits of establishing a multifaceted interspecialty airway management course for residents. It was efficient and well perceived by all the specialties involved. The interspecialty aspect allowed improvement in communication and professionalism amongst the specialties. The multifaceted approach was appreciated by the trainees and allowed a progressive manner of teaching each airway management skill. Furthermore, the positive responses from residents and staff encouraged the need for routine teaching and making the course more widely available.

### **FUTURE**

During the advanced airway management course, many of the staff felt that the trainees were not fully adept at basic airway management skills. Physicians from all three specialties involved in the supervision (Otolaryngology, Anesthesia, General Surgery) agreed that a multifaceted interspecialty course, similar to the advanced airway course, be created for basic airway management skills. A full day basic airway course has been organized and will take place in the near future.

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