Anesthesiology and the Difficult Airway – Where Do We Currently Stand?

Anesthesiology has made a significant advance in airway care since the introduction of the facemask and then followed by endotracheal tubes for assisted ventilation.[1] The need for assisted ventilation for the advancement of anesthesia care has resulted in significant improvements in health care for patients needing surgical, diagnostic, and intensive care. Practitioners involved in the care of patients requiring sedation and general anesthesia have recognized that jaw-lift, proper neck positioning, use of continuous positive airway pressure, recognizing the difficult upper airway before sedation, and meeting as a group of experts to establish the difficult airway algorithm have led to significant progress in successfully establishing an airway and decreasing airway-related morbidity.[2,3] For decades, the facemask, an oral airway, curved and straight-bladed laryngoscopes for performing endotracheal intubation, along with proper training for their use, were the mainstay of upper airway care. This then led to the introduction of the gum-elastic bougie for accessing minimally visible laryngeal inlets even after applying significant externally applied downward and upward laryngeal pressure. The bougie is then serving as a guide for advancing the endotracheal tube. Until the availability of bedside capnography became available for confirming successful endotracheal intubation, practitioners relied on clinical signs that included observing chest expansion, auscultating for bilateral breath sounds, and the use of an esophageal detector device.[4] Currently, bedside capnography is a requirement for documenting successful endotracheal intubation. Dr. Archie Brain from the United Kingdom realized that facemask ventilation requires significant expertise and skill to prevent stomach distension and often required not only jaw-lift but also an oral airway for effective lung ventilation. After several prototypes, he successfully introduced the laryngeal mask airway (LMA).[5] This was a significant contribution of the 20th century to upper airway care. Along with the use of fiberscope devices, practitioners became increasingly comfortable in providing care for patients with a difficult upper airway.

The video laryngoscopes, a recent addition, have received uniform reception by anesthesia providers, intensivists, E.R. physicians, pulmonologists, neonatologists, and paramedics.[6-10] They not only serve as a great teaching tool but also have allowed smooth and safe introduction of either an endotracheal tube, an endotracheal tube introducer, or fiberscopes in the care of both anatomically normal upper airways and also those with a difficult upper airway in newborns, infants, children, adolescents, and adults. A video laryngoscope is any laryngoscope with a built-in video camera that allows the process of airway management to be watched on a screen that is either attached to the handle of the laryngoscope itself or is freestanding. Currently, there are several video laryngoscopes commercially available with different designs of the laryngoscope blade-straight, curved, as well as hyper-angulated.[6] Some of the blades are channeled for guided endotracheal tube advancement. In case there is no channel on the blade, most video laryngoscopes require the endotracheal tube to be preshaped with a stylet. There are many reports of their successful use during difficult airway care.[11,12] A recent Cochrane review reports that video laryngoscopes improve the glottis view and may reduce the number of failed intubations, particularly in patients presenting with a difficult airway. Despite this, there is no current evidence that use of a video laryngoscope reduces the number of intubation attempts or the incidence of hypoxia or respiratory complications.[13] It has not been shown that any video laryngoscope is superior when compared to another and the choice is based on the preference and familiarity of the person managing the upper airway.

In a "cannot intubate – cannot ventilate" scenario, the American Society of Anesthesiologist difficult airway algorithm suggests the use of a supraglottic airway device (SAD). There are the first-generation SADs and more modern second-generation SADs. The first-generation SADs include the classic and flexible LMA as well as the laryngeal tube and Cobra perilaryngeal airway. These devices have been further developed with the ultimate goal of improving patient safety – mainly to reduce the risk of pulmonary aspiration of gastric contents – and have resulted in the introduction of the following second generation SADs: LMA ProSeal and LMA Supreme, I-Gel supraglottic airway, and laryngeal tube suction II. All these second-generation SADs have a separate lumen to access the stomach and aspirate gastric contents. In addition, some of the SADs can be used as a conduit for intubation, which makes them a very useful tool in the unanticipated difficult airway.[14,15] Overall, second-generation SADs are recommended in the setting of a difficult airway.[3] Table 1 summarizes the currently available SADs.

Almost all advanced anesthesia practice sites currently keep prepared a difficult airway cart equipped with items to support practitioners during the care of a patient with an expected and unexpected difficult airway. These carts are equipped with gum elastic bougies, SADs, cricothyrotomy kits, esophageal obturator airways, endotracheal tube-changers, and support items to perform fiberscope and video laryngoscopy. Furthermore, present is a system to perform jet-ventilation. Kept next to the cart are video laryngoscopes and a fiberscope tower. The set-up used at the University of Minnesota is displayed in Figure 1.

When a difficult airway is encountered, it is of utmost importance that the management of the airway is accurately documented in the patient's medical record to guide and facilitate future airway management. This information should be shared with the patient as well. Currently, this is done most of the time by orally informing the patient and relatives or with a letter to the patient to provide to future practitioners. It is not hard to imagine that with this way of communication quite frequently important information in regards to airway care is lost. To overcome this communication gap, Shanahan *et al*. developed a website which allows the practitioner to enter information about a patient's difficult airway, create a printed letter to the patient, and access the patient's information online with the help of an accompanying smartphone application.[16]

Table 1: Currently available supraglottic airway devices

SAD	Access to stomach	Conduit for intubation	Integrated bite block
LMA Classic	–	–	–
LMA Supreme	+	–	+
LMA ProSeal	+	–	+
LMA Fastrach	–	+	–
i-gel® supraglottic airway	+	+	+
AirQ® Masked Laryngeal Airways	–	+	+
Laryngeal tube	–	–	–
Laryngeal tube suction	+	–	–

LMA: Laryngeal mask airway, SAD: Supraglottic airway device

In conclusion, the practice of airway care during anesthesia and critical care of patients has advanced significantly since the introduction of open drop ether. The facemask and oral airway played a major role in the beginning and this was followed by the introduction of the endotracheal tube. Uses of low-pressure, high volume cuffed endotracheal tubes are currently the standard of care during anesthesia. However, there will always be patients with a difficult upper airway. Experienced practitioners are skilled in detecting these patients' preinduction and taking appropriate measures to establish successful endotracheal intubation with the devices that are currently available. The availability of the difficult airway cart along with the video laryngoscopes and fiberscopes has improved airway management in patients with an unexpected difficult upper airway. At our institution, all practitioners and trainees participate in a periodic airway simulation drill [Figure 2].[17] This reinforces everyone's knowledge about the contents of the difficult airway cart and provides an opportunity to do a hands-on practice in both cadavers and mannequins to increase familiarity and the steps that one needs to use to successfully encounter the unexpected difficult upper airway. This editorial provides a brief prelude to several articles in this journal related to the care of patients with a difficult upper airway.

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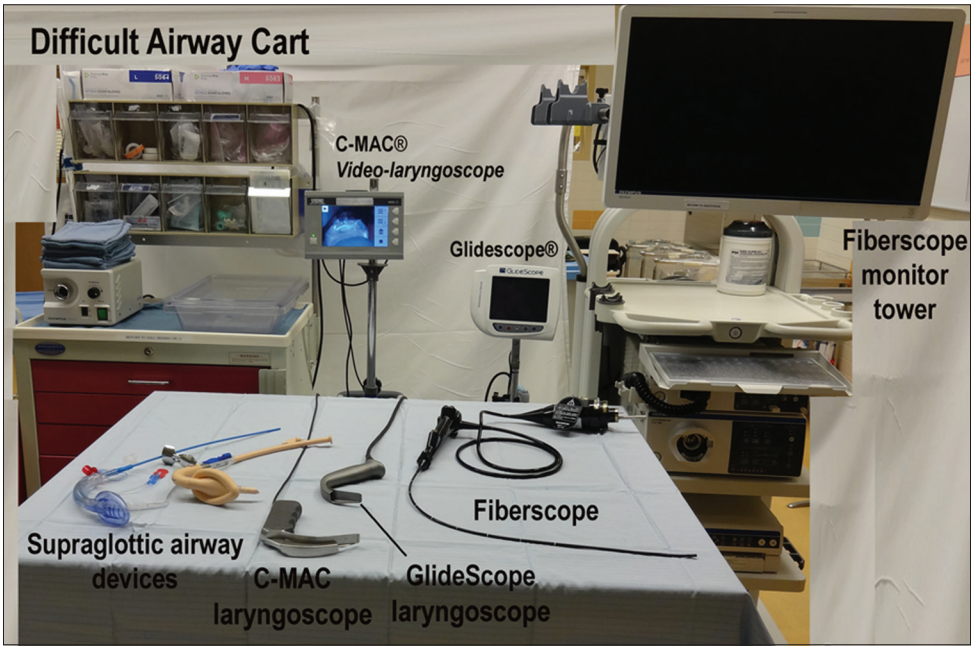

Figure 1: A photographic display of the difficult airway cart, supraglottic airway devices, video laryngoscopes, and fiberscope with TV tower that are in use at the University of Minnesota. The difficult airway cart includes items such as the gum-elastic bougie, endotracheal tube-changers, cricothyrotomy and jet-ventilation kits, supraglottic airway devices, and support items such as anti-fog and lubricant for the fiberscope, local-anesthetic atomizers, and oral airways to support fiberscope introduction. All practitioners at the institution make up these carts with a joint discussion, and so, the contents will vary from institution to institution

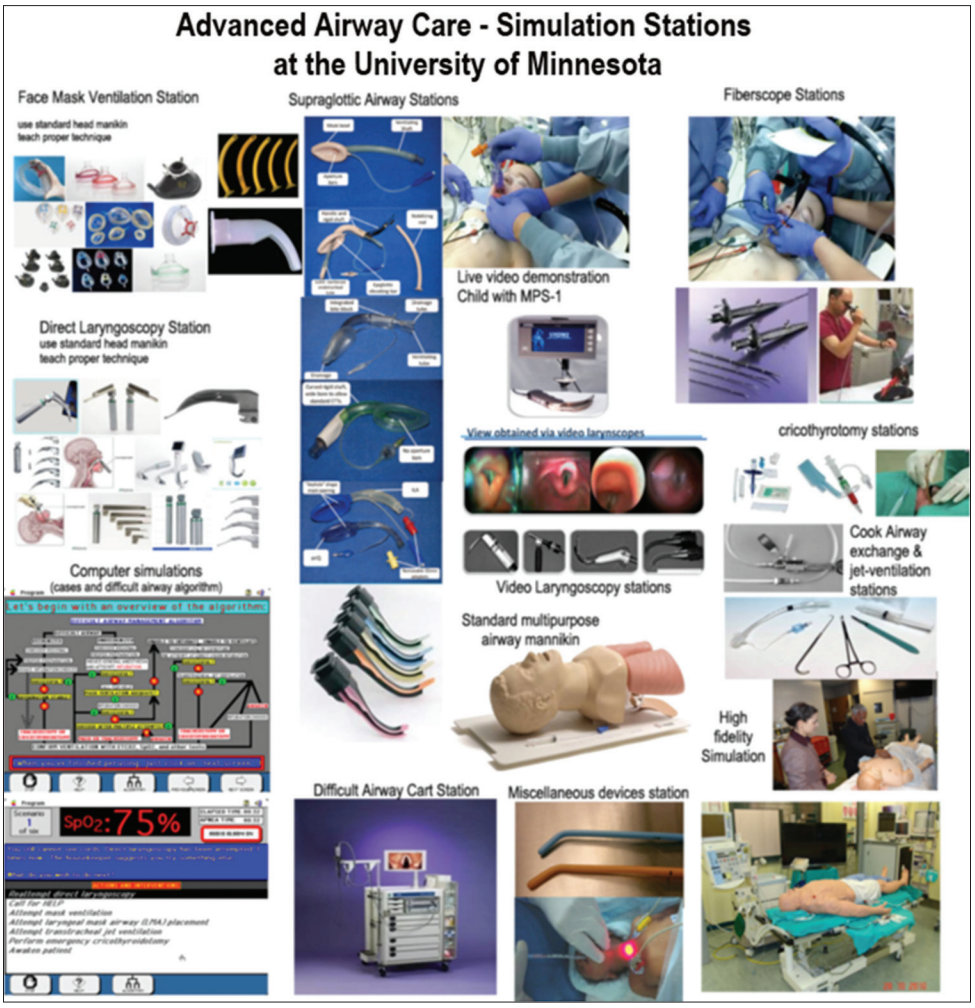

Figure 2: Different stations of the difficult airway workshop as taught at the University of Minnesota. The workshop detailed in the figure is for those interested in advanced airway care. Intensivists, pulmonologists, emergency medicine physicians also participate to learn and teach different aspects of airway care

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References

1. Myers JA. Masters of Medicine – A Historical Sketch of the College of Medical Sciences. University of Minnesota 1888-1966. 1st ed. St. Louis Missouri: Minnesota Medical Foundation, Warren H. Green, Inc.; 1968.
2. American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Practice guidelines for management of the difficult airway: An updated report by the American Society of Anesthesiologists Task Force on Management of the Difficult Airway. Anesthesiology 2003;98:1269-77.
3. Frerk C, Mitchell VS, McNarry AF, Mendonca C, Bhagrath R, Patel A, *et al.* Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. Br J Anaesth 2015;115:827-48.
4. Foutch RG, Magelssen MD, MacMillan JG. The esophageal detector device: A rapid and accurate method for assessing tracheal versus esophageal intubation in a porcine model. Ann Emerg Med 1992;21:1073-6.
5. Brain AI. The laryngeal mask – A new concept in airway management. Br J Anaesth 1983;55:801-5.
6. Yumul R, Elvir-Lazo OL, White PF, Sloninsky A, Kaplan M, Kariger R, *et al.* Comparison of three video laryngoscopy devices to direct laryngoscopy for intubating obese patients: A randomized controlled trial. J Clin Anesth 2016;31:71-7.
7. Boehringer B, Choate M, Hurwitz S, Tilney PV, Judge T. Impact of video laryngoscopy on advanced airway management by critical care transport paramedics and nurses using the CMAC pocket monitor. Biomed Res Int 2015;2015:821302.
8. Vanderbilt AA, Mayglothling J, Pastis NJ, Franzen D. A review of the literature: Direct and video laryngoscopy with simulation as educational intervention. Adv Med Educ Pract 2014;5:15-23.
9. Pieters BM, Eindhoven GB, Acott C, van Zundert AA. Pioneers of laryngoscopy: Indirect, direct and video laryngoscopy. Anaesth Intensive Care 2015;43 Suppl: 4-11.
10. Aziz MF, Kim D, Mako J, Hand K, Brambrink AM. A retrospective study of the performance of video laryngoscopy in an obstetric unit. Anesth Analg 2012;115:904-6.
11. Mahran EA, Hassan ME. Comparative randomised study of GlideScope® video laryngoscope versus flexible fibre-optic bronchoscope for awake nasal intubation of oropharyngeal cancer patients with anticipated difficult intubation. Indian J Anaesth 2016;60:936-8.
12. Aziz MF, Abrons RO, Cattano D, Bayman EO, Swanson DE,

Hagberg CA, *et al.* First-attempt intubation success of video laryngoscopy in patients with anticipated difficult direct laryngoscopy: A multicenter randomized controlled trial comparing the C-MAC D-blade versus the GlideScope in a mixed provider and diverse patient population. Anesth Analg 2016;122:740-50.

13. Lewis SR, Butler AR, Parker J, Cook TM, Smith AF. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation. Cochrane Database Syst Rev 2016;11:CD011136.
14. Timmermann A. Supraglottic airways in difficult airway management: Successes, failures, use and misuse. Anaesthesia 2011;66 Suppl 2:45-56.
15. Kleine-Brueggeney M, Theiler L, Urwyler N, Vogt A, Greif R. Randomized trial comparing the i-gel™ and Magill tracheal tube with the single-use ILMA™ and ILMA™ tracheal tube for fibreoptic-guided intubation in anaesthetized patients with a predicted difficult airway. Br J Anaesth 2011;107:251-7.
16. Shanahan E, Huang JH, Chen A, Narsimhan A, Tang R. Difficultintubationapp.com – A difficult airway electronic record. Can J Anaesth 2016;63:1299-300.
17. Belani K. Simulation for Airway Management. 1st ed. New Delhi, India: Jaypee Brothers Medical Publishers (P) Ltd.; 2017.

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Website: www.annals.in

DOI: 10.4103/0971-9784.197814

How to cite this article: Richtsfeld M, Belani KG. Anesthesiology and the difficult airway - Where do we currently stand?. Ann Card Anaesth 2017;20:4-7.

Received: December, 2016. **Accepted:** December, 2016.