

Five Things That Need To Change Now About Current Airway Management Practices J. Adam Law. Halifax, NS, Canada.

Dr. Andy Ovassapian was a tireless advocate for safe airway management. A superb clinician, mentor, researcher, and above all, educator, Dr. Ovassapian was a pioneer in advancing the use of awake fiberoptic intubation for the difficult airway patient. Since then, other cognitive and equipment innovations in airway management have further benefited the cause of patient safety. I offer the following thoughts on directions we might need to take from this point forward.

1. Can't intubate, can't oxygenate: where do we go from here?

NAP4¹ and studies of closed legal claims² are consistent in their reporting on the can't intubate, can't oxygenate (CICO) scenario: in some cases, the situation arose from an unwise decision to manage the airway after the induction of general anesthesia, rather than by awake tracheal intubation; in others, it may have been hastened by multiple attempts at an intubation technique already proven unsuccessful. There was frequently no attempt to place a supraglottic airway (SGA) before attempting emergency front of neck airway (eFONA) access. When attempted, often the attempt at eFONA was unsuccessful in the hands of anesthesia providers, or even if successful, it sometimes occurred too late to save the patient from brain damage or death. So, here's what needs to change in our teaching about, and management of the CICO situation:

- An ounce of prevention is worth a pound of cure. Most of the foregoing issues are cognitive. So it's up to the educators and experts in human factors to design programs that address them, for trainees and at the continuing education level. Suspected or known obstructive pathology? We need to teach the need for upper airway assessment enhanced by pre-operative nasendoscopy³, or CT assessment of lower airway obstruction⁴. National airway guidelines need to address planning, not just difficulty encountered in the already-unconscious patient. And we need to keep our staff and trainees comfortable with, and competent in awake intubation.
- Human factors experts need to weigh in on why we perseverate at techniques that have failed, or why we might be late in accepting the need for eFONA, *and they need to supply mitigating strategies* that are accessible and reasonably easy to implement. Enough with the entertaining gorilla/basketball videos: we need a finite number of effective solutions that work, and that we can use tomorrow.
- CICO (can't intubate, can't oxygenate): right term? Fact is, if you review the various national airway guidelines, only about half of them use the term 'CICO'. Others refer to the failure of 'ventilation' rather than 'oxygenation'. Critics of the term 'CICO' suggest that it may lead to perseveration with futile attempts at tracheal intubation and face mask ventilation (FMV). The very term sounds binary, and may invite overlooking one of the *three* pathways to oxygenate the patient: by tracheal intubation, face mask or SGA ventilation. And what of the pre-hospital jurisdiction that doesn't intubate at all? They still need a trigger for eFONA, and 'CICO' won't work. To add to the mess, some experts advocate for immediate onset of eFONA after the complete failure of all three pathways of tracheal intubation, FMV or SGA ventilation, even in a patient still saturating at 100%, arguing against any mention of oxygenation as an eFONA trigger. Personally, I would advocate for the term 'can't ventilate, can't oxygenate' (CVCO). 'Can't ventilate' would pertain to the failure of ventilation by all three pathways. Those who believe in the onset of eFONA at that point regardless of oxygenation status would go ahead with it, while others could at least use the first 'CV' as an indication to 'prime' for the very imminent need for eFONA at the first indication of 'CO', manifested by a falling oxygen saturation. Or, if both 'CV' and 'CO' occurred at any point, eFONA would proceed immediately.
- And speaking of 'priming', this concept now appears in a number of publications to help raise situational awareness of the incipient need for eFONA and to help break fixation error/perseveration with one technique, such as tracheal intubation. This makes good sense. An Australian document on the 'transition from supraglottic to infraglottic rescue in the CICO scenario'⁵ advises that regardless of SpO₂, the clinician should strongly consider calling for help after the failure of *one* of the three pathways of tracheal intubation, face mask or SGA ventilation, and when *two* pathways are substantially unsuccessful, should declare intent and mobilize resources for eFONA.
- eFONA: Best technique? Wow, emotions run hot on this one, depending on where in the world you live. Here's the thing: you should probably use a technique in which you've been well trained and for which equipment is readily available. Further, in a stressful situation, you should probably not have to decide which of two (or more) techniques to use. Trouble is, we're unlikely to see a RCT deliver an

answer on the best technique. So, we're relegated to case series and expert opinion, although neither should be ignored. My advice is to recognize that the steps more proximal to putting knife or needle to skin are the ones likely to save the patient from brain damage or death. No matter how good, no eFONA technique will succeed if performed on an already-expired or brain damaged patient. As long as you're practiced in your technique of choice, have the gear and a plan for its failure, fill your boots and use your eFONA technique of choice. Without the evidence one way or the other, we have to stop spending too much time on this one.

Fortunately, most of us will never get there. But I absolutely believe that every clinician with a mandate for airway management must (a) know when, and (b) be willing and able to perform timely eFONA.

2. Airway management outside the OR: we're all in this together

Without doubt, clinicians managing airways of critically ill patients in the emergency department (ED), intensive care unit (ICU) or ward are dealing with an unforgiving population. Difficult to pre-oxygenate, often poorly positioned, dodgy hemodynamics, other resuscitation priorities, a poor array of equipment options, crowd control, you name it. Is it any wonder that NAP4 signaled a higher rate of airway-related morbidity & mortality in those settings (albeit with small overall numbers)⁶? But here's the thing: anesthesiologists deal with a similar population of critically ill patients in the operating room, seemingly with lower rates of airway-related morbidity and mortality (M&M). Maybe the procedures are elective or semi-elective but the anatomic and physiologic issues are real. So why the difference in M&M, and what needs to change, to address it?

- Equipment: Difficult airway equipment is now available at reasonable cost, often in single-use formats. Nothing is hugely expensive. Arguably, to not have a unit fully equipped with effective routine and difficult airway gear, ideally housed in carts standardized to those in other areas of the hospital, represents a failure of leadership. The available equipment should address all phases of airway management, including tube exchange and extubation.
- Staffing: For the critically ill, physiologically unforgiving patient requiring airway management, what's needed to minimize M&M is a high level of expertise and experience. Despite this, especially in the ICU setting outside regular working hours, staffing is by trainees, often junior. Economics or entitlement (e.g., attending staff not physically providing overnight coverage) must not be prioritized over patient safety. Similar reasons for violating basic safety principles are simply not tolerated in other industries.
- Training in airway management techniques: Depending on patient (and trainee) volumes, in many units and departments, it's a constant struggle to provide ample opportunity for both attending and trainee staff to attain and maintain requisite airway management skills. Most procedures in clinical medicine have a learning curve of 50-100 repetitions, and tracheal intubation facilitated by direct laryngoscopy (DL) or video laryngoscopy (VL) is no exception^{7,8}. It's a given that laryngoscopy and intubation skills are necessary for the EP, intensivist and perhaps hospitalist, but so are skills in SGA placement, as a vital airway rescue maneuver. And especially for the intensivist, skills are needed in tube exchange and extubation over an airway exchange catheter. And yet, there's little opportunity in the ED or ICU to attain and maintain skills with the latter devices in 'routine' or lower acuity cases. That opportunity does exist, though, in the operating room. Emergency physicians, hospitalists, and intensivists must be offered (mandated?) access to the operating room to obtain and maintain the requisite experience, in elective surgical patients. For this to happen, leadership must be assertive, good communication must occur between specialties, silos broken down, and sometimes, egos assuaged. Just as the ICU is a much-needed resource for Anesthesia providers' sick patients, the operating theater should be considered a similarly vital resource for intensivists, EPs and their trainees.
- Optimized intubating conditions: Perhaps following from the foregoing bullets, at least in North America, in many ICUs, there's a tendency to not use neuromuscular blocking agents (NMBAs) to facilitate tracheal intubation. Dealing with a similar population, emergency medicine embraced NMBAs decades ago. Evidence exists in the literature of fewer complications and improved first-attempt success rates with use of NMBAs in the critically ill patient⁹. If worried about a failure to secure the airway following induction and use of a NMBA, that should be addressed by attention to training and appropriate staffing, not by routinely omitting a helpful pharmaceutical agent!

We're all in this together, and should work towards the common goal of safe airway management. Let's talk amongst ourselves about how best to attain and maintain competence for all of our attending staff

and trainees, thus helping ensure the patient has the safest possible experience whilst under our one roof, regardless of their location under the roof.

3. Video laryngoscopy: truly a new paradigm?

Videolaryngoscopy (VL) might be wonderful, for all kinds of reasons. But what are the reasons, and are they subjective opinion, impression, or objective fact? As experts and educators in airway management, we need to know. Does VL really deliver an improved first-pass or overall tracheal intubation success rate compared with direct laryngoscopy (DL)? In both routine and difficult airway patients? In the hands of both less and more experienced clinician? With fewer complications? And importantly, are all videolaryngoscopes sufficiently similar in design and function that in studying the foregoing, they can be considered together? I have my own clinical impressions, but in seeking to base those impressions on published evidence, I find myself coming up short. So here's what needs to change...

- 'New paradigm or just another tool'?¹⁰ Many studies of videolaryngoscopic-aided tracheal intubation have documented high success rates, regardless of blade design. However, these success rates are often no better than those reported for many other alternatives to DL such as the lighted stylet¹¹ or for that matter, DL with adjunctive use of the tracheal tube introducer (TTI)¹²⁻¹⁴. Absent a proven first-pass or ultimate success rate benefit over other modalities, VL is just another tool – albeit perhaps one with certain niche uses (e.g., hyper-angulated blade video laryngoscopy [HA-VL] for the patient with known difficult DL, or Macintosh blade video laryngoscopy [Mac-VL] to help feed back to the student of DL in real time) – and *not* a “new paradigm”. In other words, as airway experts, enthusiasts and educators, until truly convinced of a higher success rate (or other significant outcome measure) with Mac- or HA-VL, we must continue to advocate for careful planning and implementation of the safest airway management strategy for each patient (including awake intubation). We must not allow students and practicing clinicians to fall in to the trap of expecting VL to prevent or address all difficult airway situations. To do otherwise might run the risk of increasing, and not decreasing airway-related morbidity and mortality.
- HA-VL and Mac-VL: apples and oranges. Consider a Grade 3, tip-of-epiglottis view encountered during DL, despite optimizing maneuvers. Given the choice, I suspect that most experienced clinicians would opt for an HA-VL blade rather than a Mac-VL blade for a next attempt, if using VL. I certainly would, as the blade more likely to deliver an improved view of the larynx. But here are my concerns. I suspect that many users, and possibly even some experts and educators don't have a good handle on the difference between HA-VL and Mac-VL – either in terms of the expected view that each can deliver or of expected ease/difficulty with subsequent tracheal tube delivery. Thus, an unthinking recommendation for the ubiquitous use of HA-VL for all laryngoscopies to help get a good laryngeal view may fall flat if not accompanied by training in ‘around-the-corner’ tube delivery. Equally, in the foregoing ‘tip-of-epiglottis’ scenario with DL, the clinician believing that any VL will deliver an improved view of the larynx might be severely disappointed in what's revealed (or not) by moving to Mac-VL. Of particular concern to me is the rampant use of the undifferentiated term “videolaryngoscopy” in the literature, despite very different efficacy and tube delivery implications of Mac-VL and HA-VL. This might leave the casual reader to infer that going in to a difficult situation, any VL will do. This needs to change.
- Meta-analyses of “videolaryngoscopy” studies: too heterogeneous! Following from the foregoing, I informally reviewed the 20 or so published systematic review/meta-analysis publications on VL. Interestingly, of analyses that include more than one brand of video laryngoscope, most mix studies of HA-VL with Mac-VL. Thus, if as I do, you believe that HA-VL and Mac-VL are substantially different techniques with different indications, it's difficult to take home any conclusions. Take the 2017 Cochrane review entitled “Videolaryngoscopy vs. direct laryngoscopy for adult patients requiring tracheal intubation”¹⁵. There were two primary outcomes: (1) failed intubation or change of device required and (2) hypoxemia. The meta-analysis, which included studies of HA-VL and Mac-VL, concluded that “videolaryngoscopy” resulted in a significantly lower occurrence of failed intubations. However, a sub-group analysis of only HA-VL blades arrived at a different conclusion. As more well-conducted studies of HA-VL and of Mac-VL continue to become available, I would advocate for separate meta-analyses comparing DL success rates with *either* HA-VL *or* Mac-VL as a primary outcome.
- Researchers: Right PICOs, please! As an educator and a guideline contributor, here's what I need to know to make yet another study of VL useful to me:

- **Population:** Homogeneous populations, please. Of patients (either ‘routine’ or known/anticipated/already-encountered difficult patients) and clinicians (either less experienced with *both* techniques or clinicians experienced in *both* techniques being compared). Failing that, a large population of mixed experience providers, at least.
- **Intervention:** Laryngoscopy and intubation, not just laryngoscopy.
- **Comparator:** Both Mac-VL and HA-VL need to be studied against DL *with adjunctive TTI use*. Absent the TTI, you’re tying one arm behind the back of DL, potentially making the outcome a foregone conclusion. We also need studies comparing Mac-VL with HA-VL.
- **Outcome:** Please, no more surrogates of difficulty as a primary outcome measure (time-to-intubate, I’m looking at you!). Yes, an adequately-powered study of two techniques with a 98ish% ultimate success rate might require a thousand or more patients – but that’s what we need: it can be done, and although infrequently, it *has* been done using multi-center trials¹⁶. Failing that, we must start to acknowledge retrospective or prospective database studies with extremely large numbers as higher quality evidence.

I believe we’ll get there. Researchers, thanks for doing what you do. But the early work on VL using surrogate outcome measures such as time-to-intubate has been done. Now we need large research consortiums to do multi-center trials looking at more meaningful outcomes.

4. We need to change our evolving attitude to awake flexible endoscopic intubation

Perhaps it’s just me, but I have the impression that awake flexible endoscopic (‘fiberoptic’) intubation (AFEI) is under attack. In a couple of different ways, actually. First, by the common-yet-unsubstantiated assertion that ‘we’re doing fewer awake intubations these days’ and second, by studies and accompanying editorials promoting use of VL for performing awake tracheal intubation, rather than flexible endoscopy.

- So, we’re doing fewer awake intubations? Where’s the evidence? Also frequently tempted to say that we’re doing fewer AFEIs, I’ve looked for the corroborating evidence but have failed to find it. So, I studied it at our place, with a retrospective database study¹⁷. Hypothesizing that we were indeed doing fewer AFEIs, in fact, year-over-year from 2002-13 in our tertiary care practice, it was a negative study: there was *no* significant decrease in the incidence of AFEI. An expected rise in the use of VL after the induction of general anesthesia appeared to come at the expense of earlier alternatives to direct laryngoscopy (DL) such as the Fastrach LMA, lighted stylet and Bullard laryngoscope, and *not* at the expense of AFEI. This suggests that the need for AFEI remains absolute, despite widespread substitution of earlier alternatives to DL with VL for ‘asleep’ intubation. An additional (and surprising to me) finding in our study was that the 1,554 awake intubations occurring over the studied time period represented 1.1% of total cases requiring general anesthesia with tracheal intubation. This seemed high. So it was gratifying when similar studies, one from the USA¹⁸ and another from the UK¹⁹, were published in the following years with a similar incidence (0.8% and 1.7%, respectively). Recently, a single-centre study was published that looked at the use of AFEI before and after introduction of VL²⁰. There was no decrease in the use of AFEI after VL introduction. So, we’re still doing awake intubations, with an incidence that appears consistent across countries and indeed continents, and with *no* compelling evidence (that I can find) of a decrease in the need for the procedure.
- VL for awake intubation: just because you can, does it really mean you should? There’s an ever-increasing number of publications on the use of VL for performing awake tracheal intubation. Initially case reports and case series, I must give a shout-out to the investigators who more recently have made the effort to perform and publish RCTs comparing AFEI with VL for awake intubation. There’s now even a systematic review of RCTs on the topic²¹. That said, these are my concerns:
 - In their introductory rationale for performing the studies, many authors (frequently echoed by editorialists^{22, 23}) have stated that flexible endoscopy is a difficult skill to attain and maintain – (in some cases comparing *human* endoscopy with *manikin* VL learning curve studies). Even if true, is this really a valid rationale for abandoning it? Do general surgical trainees similarly roll over and give up on attaining and maintaining skills in laparoscopic surgery simply because it’s challenging? Of course not: they’re core skills and standard of care. Neither should we.
 - VL may be feasible for some awake intubations – e.g., for the patient with only moderate predictors of difficult DL, perhaps combined with predictors of difficult face mask ventilation, and/or intolerance of apnea. But it *won’t be feasible* for many of the anatomic scenarios more

absolutely mandating awake tracheal intubation: very limited mouth opening, extreme fixed flexion deformities of the head and neck, swollen tongue, or friable base of tongue tumors, for example. So, if AFEI is needed for these most difficult of cases, why would you not use it for *all* awake intubation cases, to help maintain competence in the procedure and ancillary staff familiarity with the equipment?

- I have issues with some of the study conditions used in the RCTs comparing AFEI with awake VL. For example, in the 8 studies used in the recent systematic review²¹, although the review concluded that VL could be performed more quickly than flexible endoscopy for awake intubation, many studies excluded patients with more severe pathology (e.g., very limited mouth opening); patients were often significantly sedated (e.g., to Ramsay 3 or 4) and the primary outcome measure (time) was only a surrogate for success or tolerance of the procedure. Parenthetically, in 3 of the 8 studies included in the systematic review (38%!) the dose of adjunctive remifentanyl used was either homeopathic or reported incorrectly. What else about the studies (or their peer review) was sloppy?

Ultimately, then, VL for awake intubation applies to only a subset of patients (i.e., difficult, but not too difficult) who need awake intubation under a subset of intubating conditions (i.e., substantially sedated – often contraindicated for the truly difficult situation). I submit that our mandate as Anesthesia providers is to be prepared with a technique for awake intubation – AFEI - that won't fail the patient with the most difficult of difficult airways.

So, what needs to change? We have to stop trash-talking AFEI. Studies, editorials and now a systematic review/meta-analysis on awake VL might be sending the wrong message to the clinician looking to rationalize not making the effort to maintain the skill. AFEI is still happening, it's still needed, and until ECMO technology can quickly be established through a couple of peripheral 16G IV catheters (!), it's not going away. While VL can perhaps be used for some awake intubations, it *will not be feasible* for more severe pathologies. Dr. Ovassapian's message still applies: at least for anesthesia providers, we have to continue to teach, train in, and maintain competence with AFEI, so that we have an effective technique for almost *all* of our difficult airway patients.

5. Does every country really need to publish their own airway management guidelines?

Guidelines exist to assist with the cognitive component of airway management. Many have been updated within the last 5 years, often under the auspices of national anesthesiology or airway societies. As generally well researched and well written articles, they have become influential publications, some beyond their national boundaries of origin. And therein lies the problem. For example, as a Canadian, when facilitating a teaching session with trainees, whose guidelines do I espouse? There are Canadian guidelines^{24, 25}, but the neighboring DAS^{26, 27} and ASA guidelines²⁸ are more likely to be referenced in standard texts and journals and are thus more influential. The actual message tends to be fairly consistent between guidelines, with minor variations in pathways leading toward common endpoints. In actual fact, I often end up discussing all of the foregoing guidelines but in so doing, likely dilute their message!

Wouldn't it be wonderful if we would rise above the perhaps siloed thinking that leads to the publication of national guidelines, particularly with the now-global and instantaneous nature of communication? General enough to allow for minor variations in local practice, but specific enough to deliver a useful message for safe airway practice, universal guidelines should apply within and outside the walls of the operating theater and across national boundaries. Humans have common anatomic and physiologic issues universally, so why not universal airway management guidelines to guide safe practice? In fact, working and advisory group members from 17 countries have joined forces in the 'Project for Universal Management of Airways' (PUMA) for just this purpose²⁹. They hope to have draft universal guidelines ready for presentation and audience comment at the World Airway Management Meeting in Amsterdam in November 2019. An ambitious undertaking, even if the resulting guidelines are on target, a second challenge will be to encourage their uptake, particularly in those countries already well-served by high-profile and effective airway guidelines.

Conclusion

Since Dr. Ovassapian's valuable contributions, I believe we've made further progress in improving the safety of airway management, and that's gratifying. That said, many new devices, techniques and cognitive aids have gained traction based on their intrinsic appeal, before a substantial

evidence base has been published. Thus, for researchers and educators, there's still plenty of opportunity. Equally, until new techniques are proven superior (or at least non-inferior), we must not prematurely turn our backs on the 'tried and true'.

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