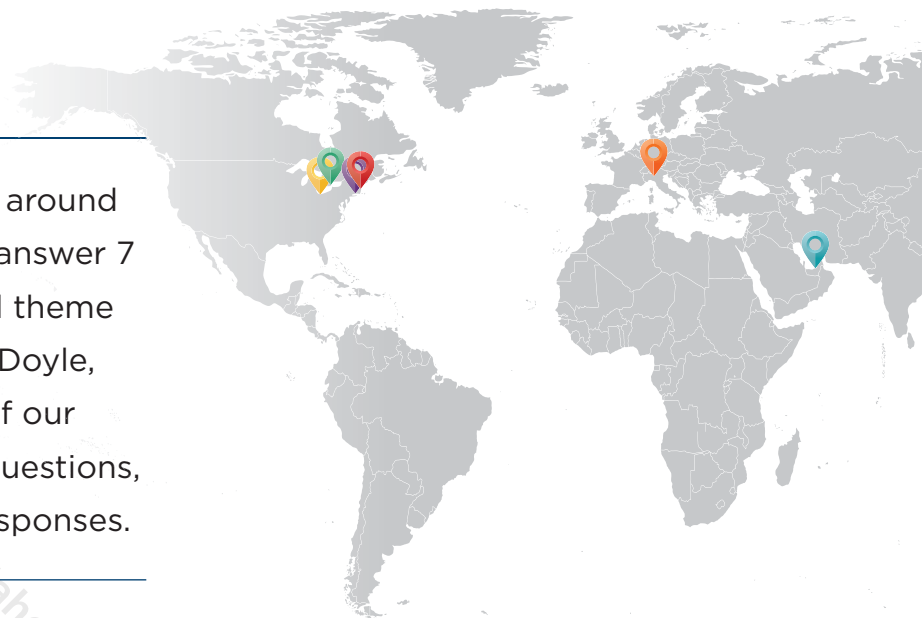




Airway Management Roundtable: Seven Questions

Six anesthesiologists from around the world were asked to answer 7 questions, whose general theme is airway management. D. John Doyle, MD, PhD, picked the members of our expert panel and wrote all the questions, to which he supplied his own responses.



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Drs. Abdelmalak, Doyle, and Spiegel reported no relevant financial disclosures.

Dr. Cooper disclosed that he is the unpaid chairman of the Scientific Advisory Board of Verathon Medical.

Dr. Frova disclosed royalty agreements with Cook Medical (as inventor of the Frova Intubating Introducer) and Teleflex Inc (as the inventor of the PercuTwist and EasyCric).

Dr. Rosenblatt disclosed that he is an uncompensated advisor to Ambu.

With the advent of inexpensive video laryngoscopy, will there still be a place for direct laryngoscopy a decade from now?

Doyle: Yes. As an analogy, the fact that automatic blood pressure machines are readily available does not mean that nurses and doctors should not be taught manual blood pressure measurement via auscultation of Korotkoff sounds.

Frova: I would say that inexpensive video laryngoscopes (VLs) do not exist today, but a few of them are less expensive than others because they are partially disposable. In 10 years, many technological improvements may happen, but my feeling is that direct laryngoscopy not only will have a place in the anesthesiologist's armamentarium, but also that its use must be taught and expertise acquired. Let's look back to the advent of sophisticated and expensive ventilators that did not eliminate the need and utility of a trivial Ambu bag (in an emergency, in a helicopter, in an ambulance, and in developing countries). So, I am almost sure that the MAC laryngoscope will still be used by anesthesiologists for a long time to come.

Abdelmalak: Yes, direct laryngoscopy will still play a role due to its long track record of utilization, familiarity, success, and safety, in addition to its simplicity and low cost. With that in mind, the role (ie, its market share) may diminish if video laryngoscopy technology and the price of disposable blades for it become much cheaper than they currently are.

Cooper: I don't believe that inexpensive video laryngoscopy has arrived. When and if it does, direct laryngoscopy will become a relic. I think that we are witnessing a divergence of approaches; some manufacturers offer more sophisticated equipment, increasing cost, and limiting market, which in turn increase cost. Other companies are trying to cut costs by sticking to basic needs. If the right balance can be found, it will encourage more widespread use of video laryngoscopy, increasing the competition and lowering production costs. Once this occurs, users will experience the benefits and few will want to revert to direct laryngoscopy. Unfortunately, less robust construction may lead to patient injury and equipment malfunction, and slow the use of

video recording for clinical documentation and quality improvement.

Spiegel: Perhaps not in the traditional sense. The best VL is yet to be designed, but we are getting closer. I think the best VL is one that has the traditional direct viewing angle—the 30-degree MAC 3. This direct-view angle blade still allows for bougie placement, a critical advantage of the direct-view approach.

Rosenblatt: For the last 10 years, I've been predicting that direct laryngoscopy would be gone from the operating room in 5 years. Obviously, I was very wrong. However, the reason for my error has changed during the last decade. At first, video laryngoscopy was not as widely adopted as I expected because, I believe, it was misused by clinicians, resulting in its full potential not being realized. When handed their first VLs, most clinicians looked at the technique as "direct laryngoscopy plus." In other words, video laryngoscopy was not appreciated as a completely new way to visualize and then instrument the larynx and trachea. Most clinicians treated video laryngoscopy as a helpful adjunct to delivering tracheal tubes the way we did with direct laryngoscopy. It later became apparent, primarily through experience and teaching by organizations such as the Society for Airway Management, that we needed to develop a whole new set of skills for successful video laryngoscopy.

The second barrier was cost. The early VLs were not cost-effective when compared with direct laryngoscopy combined with simple adjuncts, such as the gum elastic bougie. Now, with the availability of low-cost CMOS (complementary metal-oxide semiconductor) imaging technology, the expense of video laryngoscopy has plummeted.

Therefore, in answer to this question, I would say yes. I believe that within a decade most routine laryngoscopies will be performed with some sort of video technology, especially in the environment of the operating room. There will be venues worldwide where direct laryngoscopy will survive, not simply because of cost, but also due to lack of technology maintenance.

One might argue that if we were to do one thing to make direct laryngoscopy more successful in marginal cases, then that would be to emphasize to our trainees the use of simple, inexpensive airway introducers (eg, "gum elastic bougies"). Do you agree that they are underused?

Doyle: Absolutely. Use of an airway introducer and knowing how to position the obese patient for ease of intubation (via the "head-elevated laryngoscopy position") are two of the simplest, most inexpensive techniques available to make tough laryngoscopy easier.

Frova: I agree, especially with the first part of the question. I think that cheap, simple, ergonomic, and effective devices will always have a place in airway management, and they remain very useful for teaching novices how to use a bougie. Combining direct laryngoscopy with a

tracheal introducer (bougie is a bit of a generic term) is the simplest and most effective technique to cope with a limited view of the laryngeal inlet and vocal cords.

I also agree with the second part of the question. According to some literature and sparse sales data,¹ last year bougies were used 1 million times all around the world. Supposing they are needed in only 3% of intubations, what is 1 million uses in the world when in Italy alone subjective approximations find that 2.5 million intubations are performed every year? They are clearly underused. I have no objective data, but I have the feeling from our airway management courses that 50% of colleagues ignore indications and their correct use.

Abdelmalak: I totally agree that they are underused, and together with direct laryngoscopy, provide an economic alternative to other, more expensive technologies used in managing certain difficult airways—such as those described as having an “anterior larynx” or high Cormack-Lehane grade. Especially when such a situation is unanticipated, there will be no need for a second laryngoscopy or a different laryngoscope; just add the bougie and proceed.

Cooper: I agree that they are less often used in the United States compared with the United Kingdom and Australia. However, I would also argue that we should not acquiesce to blind intubation by pushing the limits

of direct laryngoscopy and attempting to intubate a larynx that we cannot see (ie, Cormack-Lehane grade 3 or 4). Absent an emergent intubation, I would prefer to use a technique that enables visualized intubation, such as video laryngoscopy. At least in the developed world, we should neither encourage nor defend the continuation of blind intubation. Multiple attempts are associated with increasing complications, which are difficult to justify by the increased cost.

Spiegel: Definitely underused. The Cormack-Lehane classification system is based on the decision tree to use or not use the bougie. With direct-view video laryngoscopy we can still use this learning approach, which I believe is excellent, to pass on to the residents.

Rosenblatt: I would agree with Dr. Doyle that one of the most simple and cost-effective adjuncts that we can advocate to improve success with direct laryngoscopy is use of the airway bougie. I also believe that we need to emphasize the practice of making our first attempt at laryngoscopy the best attempt, that is, positioning the patient correctly, making sure that we have correct working equipment at hand, and being confident that we’ve done a thorough preoperative evaluation. Although we perform laryngoscopies and intubations many times a day, we should never take it for granted and always have thoroughly prepared ourselves and our patients for success.

There are so many published difficult airway algorithms out there now, coming from America, Canada, Britain, Italy, Germany, China, etc. How does one choose between competing algorithms other than to choose on the basis of personal nationalist leanings?

Doyle: Nationalist leanings work for me. However, for a more nuanced answer, please read the chapter on this very topic by Sorbello and Frova in our upcoming book.²

Frova: Actually, 8 guidelines on airway management have been published during the last 20 years, but I do not think there is competition among them. It might be wise to read all these documents, but apply your own country’s national guidelines to daily practice. It is redundant to underline that guidelines are only suggestions, and every anesthesiologist has the ability to interpret them, without rigidity to a dogmatic mandatory assumption, and adapt them to a specific clinical scenario, taking into account that if he or she chooses to act differently from suggested guidelines, then he or she should be able to support and justify the choice. What is mandatory is that the fundamental goals of a suggested guideline should be shared and accepted.

Abdelmalak: Although difficult airway algorithms are mostly meant to be referred to as “guidelines” rather

than standards of care, they are often considered as such. Many times individuals place emphasis on whether the guidelines have been followed when a difficult airway scenario is encountered. Perhaps one’s own national difficult airway algorithm should be considered when developing personal or institutional policies or practices.

However, reviewing and studying other countries’ algorithms can be extremely helpful and may guide clinicians to better implement their own country’s algorithm. For example, the US difficult airway algorithm calls for making certain decisions as the initial step in difficult airway management, such as whether a patient should be intubated awake or after induction of anesthesia, and so forth. The Canadian difficult airway algorithm nicely reviews some of the circumstances and findings that should be considered in making such a decision.

Cooper: For the most part, the guidelines are based on low-level evidence, and at best, represent a consensus of opinion of experts in the area. The content of

the various guidelines is not fundamentally different, but it uses different terms and varies in specific recommendations. For example, all agree that limiting the number of intubation attempts is a worthy objective: The Canadian Airway Focus Group (CAFG2) recommended no more than 3; the Difficult Airway Society guidelines recommended no more than 4; and the American Society of Anesthesiologists (ASA) guidelines recommend limiting the number of attempts without specific guidelines. It defines a "difficult intubation" as one that cannot be achieved despite "multiple attempts." Another example concerns recognition of failed intubation/failed ventilation. CAFG2 elected to place emphasis on failed oxygenation, the ultimate objective of ventilation and objectively measurable. In the final analysis, when it comes to judging performance, an anesthesiologist is likely to be judged by a group of peers who are likely evaluating adherence to national practice guidelines. However, practice "guidelines" are just guidelines and are intended to inform clinical judgment. If wisdom is recognized in the guidelines from another national society, there is nothing to prevent its incorporation into a clinician's practice.

Spiegel: I would have trouble answering that since I am not aware of the differences. I still look to the ASA guidelines. If the algorithm incorporates too many branches, it becomes less useful.

Rosenblatt: When we drill down to their cores, we see that all the algorithms are essentially the same. Certainly

they all have identical goals, which are oxygenation and ventilation of the patient.

Cultural differences will often help to define which algorithm is better for each clinician, and that is appropriate. For example, in the case of the ASA algorithm, there are suggested pathways that may be satisfied by any number of techniques and devices, whereas the algorithms coming from Europe tend to encourage less variability on the basis of the individual clinician and suggest specific devices. However, this highlights another issue: Not only do we have algorithms supplied by societies and organizations of different countries and cultures, but also by different disciplines. For example, you may be involved in an airway resuscitation that includes emergency medicine physicians, intensivists, and nurses. A vital question is, "How do these different disciplines communicate and meld their chosen algorithms?" A resource that brings all of these algorithms together is called The Vortex Approach. The Vortex Approach, developed by Drs. Nick Chrimes and Peter Fritz,³ is a simple, visual, cognitive aid that helps to organize airway resuscitation around the 3 minimally invasive techniques (face mask, supraglottic airway [SGA] ventilation, or tracheal intubation by any means) and percutaneous emergency airway access in an easy-to-communicate manner. Not only does this cognitive aid guide the team and communicate success and failure, but it also promotes the advancement of care and prevents perseveration on any one tool or technique.

Imagine that a patient's airway is truly lost and the patient is deeply cyanotic. A surgeon arrives on the scene and wants to do a tracheostomy, instead of a cricothyrotomy, to rescue the airway. Bradycardia is setting in. What should you say or do?

Doyle: It's time for a cricothyrotomy, not a tracheostomy; tracheostomies just take too long. (One reason that tracheostomies take longer than cricothyrotomies is that tracheostomies are usually performed between the second and third tracheal rings, whereas cricothyrotomies are performed through the more easily identifiable cricothyroid membrane.) For a video on how to perform a 55-second cricothyrotomy, go to www.youtube.com/watch?v=I6wodB2S0uc. Notice how use of an airway introducer makes the procedure look so easy.

Frova: The clinical situation described, of cyanosis and bradycardia, does not permit any waste of time. An urgent tracheostomy needs 4 minutes or more to be completed and allow for oxygen delivery, in the best surgical hands. I would tell the surgeon to perform a surgical cricothyrotomy in 1 minute, or, preferably, I would perform it myself. The surgical cricothyrotomy may be performed with elementary devices (ie, scalpel-stylet-small size tube or scalpel-bougie-tube) or

be percutaneous, although it would be better if it was done using a Seldinger ergonomic set. A percutaneous cricothyrotomy could be performed in less than 40 to 50 seconds from packaging opening to oxygen delivery, as long as the physician has basic knowledge and expertise.

Abdelmalak: What I would say or do in such a scenario depends on what specialty the surgeon belongs to and his or her skill level. As the situation indicates, this is a very emergent situation that requires swift intervention. Surgeons are best in performing surgical airways, especially if they are otolaryngologists. In that case, I would not utter a word and allow them to do what they do best. On the other hand, if a different-specialty surgeon who does not have the experience or knowledge of airway management is present, I may go ahead and temporize the situation with percutaneous transtracheal jet ventilation, with which I'm most familiar, or perform a cricothyrotomy (Seldinger's technique), with which I'm

also familiar. I would then reevaluate to decide whether a tracheostomy is still needed, and determine who should perform it and the best way to accomplish that.

Cooper: I think that would depend on the surgeon, but generally I would defer. I have witnessed ear, nose, and throat surgeons perform an emergency tracheostomy far faster than I could do a cricothyrotomy.

Spiegel: That depends on what equipment we have available and the expertise of those present. An open or Seldinger cricothyrotomy is preferred over open tracheostomy for a few obvious reasons, and I would hope to convince my colleague of that approach since I am comfortable performing that procedure and could assist, if needed. Emergent tracheostomy usually ends in a bleeding disaster if done emergently.

Rosenblatt: First of all, I wouldn't be waiting for a surgeon to arrive. In question number 3, I spoke briefly about The Vortex Approach. The Vortex is a cognitive aid to help guide you through the techniques that are used in emergency airway management. If we drill down on the ASA's algorithm, only 4 techniques are available for airway resuscitation: face mask ventilation, supraglottic device ventilation, tracheal intubation, and percutaneous emergency airway access (PEAA). What I find so useful about The Vortex Approach is that, depending

on the clinical situation, it encourages no more than 3 attempts at each 1 of the 3 noninvasive techniques. After 3 attempts at each—or possibly less depending on the clinical situation—the team rapidly progresses to a PEAA. If you carefully consider this approach, you realize that PEAA may be encouraged before the oxygen saturation has fallen or before the patient becomes cyanotic. You are now performing PEAA in a patient who is likely to have a better outcome.

Getting back to your question, let's assume that a surgeon is at the bedside when the need for a surgical airway arises. My encouragement of the surgical approach depends on the skill of that surgeon and the airway at hand. If I'm working with an otolaryngologist, who I believe has competence in rapid tracheostomy, I would certainly not interfere with his or her attempts. On the other hand, if I am working with a surgeon who is less skilled or less confident in his or her skills, I would prepare and encourage that surgeon to perform transcricothyroid membrane PEAA.

Also, very importantly, I would continue attempts to manage the airway from above, as long as I could avoid disrupting the surgical attempt. That is, I would continue my efforts at mask ventilation, supraglottic ventilation, and possibly tracheal intubation. There is no reason why I should abandon what I am doing from above while a second team is working to save the patient from below.

Has the popularity of video laryngoscopy had a negative impact on the use of fiber-optic intubation? What is your experience?

Doyle: This appears to be the case, but I cannot offer supporting data. Certainly, I have encountered many cases in which the clinician judged the airway to be too difficult for direct laryngoscopy but for which fiber-optic intubation (FOI) was seen as unnecessary, given the availability of video laryngoscopy.

Frova: I suppose that sales of flexible fiber-optic instruments might have been influenced by the huge addition on the market of VLs and companies' pressure, but many of these companies produce both devices. I think that use of a flexible fiber-optic endoscope is mandatory in many nonemergent clinical settings (such as in the case of a very limited mouth opening, or for thoracic anesthesia, etc), and such an instrument is mandatory in the airway cart. In my personal experience, the VL noticeably reduced but did not abolish the use of a flexible fiber-optic endoscope in an otorhinolaryngology theater and, with some exceptions, the request for FOI in general surgery. Obviously, one could not substitute a flexible scope in the setting of thoracic anesthesia. It is important to remember that, if compared with FOI, the video laryngoscopic procedure is not so easy to perform with topical anesthesia; it requires relaxation and adequate levels of anesthesia.

Abdelmalak: Yes, it seems that practitioners prefer using the VL as opposed to the flexible fiber-optic scope in many anticipated and known difficult airway scenarios. Thus, the number of flexible FOIs performed has decreased, which may result in diminishing practitioners' skills in performing such a procedure (awake or asleep) if they have had some experience already, or never advancing their skills if they are still on the learning curve.

As for my own experience, I remain a flexible fiber-optic scope enthusiast. Realizing the caveat presented above, I make a conscious effort to continue to use or even increase fiber-optic use to maintain and advance my own skills, and to teach trainees as well. Such a skill becomes handy in managing many complex airways secondary to the head and neck cancers that I deal with on a daily basis. Such airways require the versatility of the flexible fiber-optic scope versus the VL and make for a great opportunity to train the next generation of anesthesiologists.

Cooper: My impression is that far fewer bronchoscopic intubations are being performed, and I would expect that the skill will likely deteriorate. J. Adam Law et al,⁴ however, recently reported no decline in the number of awake bronchoscopic intubations between 2002 and

2013 (averaging 1.06% of intubations), despite a significant increase in the use of video laryngoscopy. On the other hand, Wanderer and colleagues at Vanderbilt⁵ observed a significant decline and corresponding increase in the number of awake bronchoscopic and video laryngoscopic intubations, respectively.

Spiegel: Yes, it definitely has reduced the use of awake FOI. We try to do asleep FOI electively for the rare cases of which we need to know the equipment for awake cases.

Rosenblatt: The literature provides a mixed opinion on this topic but offers insight into concepts of difficult airway decision-making and management.

In 2013, Wanderer et al⁵ published a longitudinal, uncontrolled study that showed decreasing use of FOI techniques as their practice acquired more VLs. Close examination into their methods reveals that this group equated the use of the fiberscope with the use of an awake intubation technique. Awake intubation is often elected when a patient's airway is perceived to be

difficult to manage, although it is possible that routine airway management would have been adequate. They interpret their data as evidence that fewer difficult airways were encountered. In response to this report, Caldiroli et al⁶ make the comment that Wanderer's data do not necessarily reflect a reduction in difficult-to-manage airways but rather a reduction in patient airways perceived as being difficult: Availability of and experience with video laryngoscopy gave the operator more confidence in light of the preoperation evaluation findings. Counter to this, J. Adam Law et al⁴ found no decrease in the use of the flexible scope over a similar time period.

What I do believe, however, is that there can be a dangerous tendency for those who are uncomfortable with techniques such as awake intubation to default to the use of video laryngoscopy. In most cases, patient management will be successful. However, in some number, this approach will result in catastrophe, as was noted in the 4th National Audit Project (aka the NAP4) study.⁷

What is your favorite SGA, and why do you like it over the others?

Doyle: I very much like the i-gel (Intersurgical). The seal that it provides is excellent; you can intubate through it; it has both a gastric port and a bite block; and cuff-pressure issues are nonexistent. Plus, it has got me through some very tough scrapes.

Frova: LMA Classic (Teleflex) was my first extraglottic device, and for a long time remained my favorite. Years later, I switched to the LMA ProSeal (Teleflex), which remains my favorite today. Many different devices are on the market now, and this can be confusing for naive users. My advice would be to prioritize second-generation devices, such as the ProSeal or other similar devices, with proven efficacy and safety. As an alternative, choose any device that you are familiar with, which grants a good seal and combined fiber-optic basic/advanced access.

Abdelmalak: The i-gel; it has a large lumen even in the smallest adult size of 3, thus allowing for flexible bronchoscopy and/or intubation through it. It is easy to insert, has a built-in bite block, esophageal access, and a good seal around the larynx, which allows for more effective positive pressure ventilation. It is almost one-size-fits-all for adults, since size 4 fits patients 50 to 90 kg in weight. There is a lack of aperture bars such as those in the original LMA, which makes it easier to perform flexible bronchoscopy and/or intubation through it; however, it still has the epiglottic elevating bar. It is not foolproof and still does not work for some patients (because of difficulty inserting/seating, excessive leakage, or ineffective ventilation), but when that happens, I will either try a different brand of SGA or switch to

endotracheal intubation.

Cooper: I have different preferences for different circumstances, but generally I rarely use devices that don't permit gastric decompression or provide high-seal pressure.

Spiegel: LMA Fastrach (Teleflex). It allows for intubation and simultaneous ventilation. It's an ingenious device. For nonintubation, I prefer the LMA Supreme (Teleflex). I also favor the i-gel and LMA ProSeal.

Rosenblatt: There is a well-known quip that makes its rounds in medical schools: The most important part of the stethoscope is the part between the earpieces. I believe the same is true with most of our airway equipment and techniques. All of the available SGAs are capable and have been developed by imaginative minds with the backing of trial and error and research. The most important part of the SGA device and what separates one from another is the hand that is inserting it into the mouth.

On the other hand, there have been certain design advancements that separate devices and influence my choice. First, I believe that virtually all SGAs in use today should be of the second-generation type, that is, SGAs with gastric access, the facility for determining position, and the capability of achieving higher interairway pressures. I also prefer SGAs of the perilaryngeal sealer variety, that is, those that have a cuff or other solid structure that completely surrounds the larynx, as opposed to those that block the hypopharynx from above and below.

What is your favorite VL, and why do you like it over the others?

Doyle: In 2003, I first used the GlideScope (Verathon) and have been an enthusiastic supporter ever since. Above all, I like the image quality, but it is not without drawbacks: It is more expensive than I would like and not portable enough to be able to keep with you at all times. That said, the GlideScope has got me through so many difficult airway situations over the years that I must acknowledge a debt of gratitude.

Frova: This is not an easy question! Of the many devices that are available, I like specific features of several devices, but if I need to express a general preference, I would say the GlideScope due to long personal experience. As a retired anesthesiologist, I am not up-to-date on the recent developments on VLs.

Abdelmalak: The McGRATH MAC (designed and manufactured by Aircraft Medical, and distributed by Covidien). It is lightweight, portable, the screen is of reasonable resolution, and the blades are low profile, leaving room for introducing the endotracheal tube in small-mouth patients. Moreover, oftentimes one can intubate without needing a stylet, which further adds to its safety compared with other available VLs. Finally, the disposable blades are cheaper than some of the other competing brands.

Cooper: My bias favors the GlideScope, but I also have far more experience with this device. The new Titanium series is robust, does not fog, is available in a range of sizes, can be placed into relatively small mouths, provides an excellent glottic view, and makes recording and video review easy. However, there are many excellent products, including some decent single-use devices for the occasional user.

Spiegel: I favor the VLs that have both direct and indirect capabilities. There are 3: C-MAC (Karl Storz), GlideScope Direct, and McGRATH MAC. All are excellent for using the bougie, if necessary. These are ideal devices.

Rosenblatt: As I answered above, I believe that the most important variable in VL design is the hand that is holding it. I don't have a preference among the various VLs available today. I think they are all highly capable, and now that many have a variety of angulated blade options, virtually all achieve the same results. The clinician who chooses any VL and treats it as "direct laryngoscopy plus" will get into trouble. Apart from experiencing more failed tracheal intubations, they will likely cause more trauma to the patient's airway.

The nonchannel VLs introduce a "blind spot" into the process of tracheal tube placement. Once the VL has been positioned in front of the larynx, the introduction of the trachea tube is "blind" until its distal end is within the scope's visual field. There have been 11 or more published case reports of trauma to soft tissues due to this. Any new medical technology will also introduce new morbidities and the need for techniques to avoid those morbidities. Such is the case for video laryngoscopy, as described. Simply revising your technique away from "direct laryngoscopy plus" can avoid these morbidities.

Some clinicians argue that the channel-type VL is less traumatic and a better technique, but the channel-type VL reduces the independent maneuverability of the tracheal tube within the airway. For some clinicians and for some clinical situations, this will be an inappropriate choice, so I truly don't have a favorite VL. On a case-by-case basis, my choice will depend on the patient's anatomy and my experience with the various devices.

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