cessation in a mixed surgical cohort: a randomized clinical trial. *JAMA Surg* 2018; **153**: 303–11
14. Brummett CM, Myles PS. Opioid discontinuation after surgery. *Br J Anaesth* 2020; **124**: 502–3
15. Soffin EM, Lee BH, Kumar KK, Wu CL. The prescription opioid crisis: role of the anaesthesiologist in reducing opioid use and misuse. *Br J Anaesth* 2019; **122**: e198–208

*British Journal of Anaesthesia*, 125 (3): 221–224 (2020)
doi: 10.1016/j.bja.2020.06.012
Advance Access Publication Date: 17 June 2020


# Airway management equipment and practice: time to optimise institutional, team, and personal preparedness

Matthew Gibbins[1], Fiona E. Kelly[1] and Tim M. Cook[1,2,*]

[1]Department of Anaesthesia, Royal United Hospitals Bath NHS Foundation Trust, Bath, UK and [2]Bristol Medical School, University of Bristol, Bristol, UK

*Corresponding author. E-mail: timcook007@gmail.com

**Keywords:** airway management; COVID-19; human factors; standardisation; training

When the coronavirus 2019 (COVID-19) pandemic struck much of the world in late February 2020, this editorial was in final draft form. Now in early June, as the worst of the first epidemic surge wanes in the UK, we have reflected and updated its content accordingly below.

Ensuring success when managing unexpected airway difficulty relies on being adequately prepared. A 'prepared airway practitioner' has been described as one who '*performs safe airway management, displaying skill, knowledge and a full awareness of human factors, within a culture of safety …* ', and such practitioners '*should aim for expertise rather than mere competence*'.[1] This statement highlights the three main components of preparedness: the culture of safety relating to institutional preparedness, human factors relating to team preparedness, and skill, knowledge, and expertise relating to personal preparedness. Without all of these, an airway practitioner's ability to achieve reliable success when managing unexpected airway difficulty will be impaired.

One important facet of preparedness is optimising equipment and its use. The 4th National Audit Project (NAP4) highlighted equipment issues—the appropriate range of equipment, its immediate availability, and the skills and experience to use it—as significant contributors to adverse outcomes in airway management.[2] Whilst in most countries there is broad consensus around the types of equipment that should be available when encountering airway difficulty, there is less clarity about availability and preparation to ensure it can be skilfully deployed. We explore here how we can use airway equipment, and importantly its routine availability, to optimise our institutional, team, and personal preparedness.

## The education gap and routine use of 'rescue' airway equipment

Competence in using the equipment required for managing unexpected airway difficulty is an expected minimum of a prepared airway practitioner, and expertise is the goal. For trainees, the route to competence may be obvious, with detailed and specific curricula to follow.[3] Even then, trainees are often exposed to equipment with little or no official training.[1] However, for those who are no longer in training, who form the majority of practitioners, the task may be more challenging, with limited guidance on how to maintain competence with existing equipment or to achieve it when new equipment is introduced. To address this, the Australian and New Zealand College of Anaesthetists have made some strides towards mandating triennial airway rescue training,[4] but in practice this can be avoided by choosing other educational options and there is a strong argument that, in focusing only on the front-of-neck airway techniques, the wrong skill set is being emphasised.[5] In many other counties there is no process for mandating skills retention or acquisition whatsoever. In the UK barely half of trained anaesthetists get any locally delivered skills training.[6]

The adage '*practice makes perfect*' is relevant here: '*reinforcement learning*' has been studied by neurobiologists in some detail. In simple terms, neuronal circuits are either '*actors*' (those that produce an action/behaviour) or '*critics*' (those that relay feedback on the outcome of that action/behaviour) to fine tune motor skills and behaviours.[7] These interactions reinforce adjustments that bring the action or behaviour closer to the desired outcome until it is honed. Consequently, in addition to other benefits such as

knowledge and familiarity, using advanced or rescue airway equipment during our normal practice, rather than only during difficulty, will hone those motor skills we need to acquire for both competence and expertise.

## Plan A and following the evidence

The essence of Plan A as outlined in the 2015 Difficulty Airway Society (DAS) guidelines for management of the difficult airway is to maximise the likelihood of successful intubation at the first attempt.[8] Videolaryngoscopy has transformed the management of difficult airways with numerous benefits widely reported. Videolaryngoscopy enables a better view at laryngoscopy with greater operator ease and less force.[9] It leads to fewer Grade 3–4 views and fewer intubation failures. Benefits are particularly evident in higher risk patients.[9] However, benefits of videolaryngoscopy are limited to those practitioners experienced in its use; direct laryngoscopy skills do not translate into skill with videolaryngoscopy, especially devices with hyperangulated blades.[9] Gill and colleagues[10] reported that more UK anaesthetists with an interest in advanced airway management believed they were competent to teach videolaryngoscopy than had used the devices more than 10 times. For many anaesthetic procedures there is a steep learning curve for the first 30 cases, but with the learning curve not flattening off beyond at least 100 cases.[11] Regarding hyperangulated videolaryngoscopy, 76 uses were reported to be required to achieve reliable performance.[12] This sustained acquisition of expertise chimes with our own local experience where, after 5 yr of universal videolaryngoscopy, we are still gaining in expertise.[13] The 2015 DAS guidelines state that anaesthetists should be '*trained to use, and have immediate access to, a videolaryngoscope*', and that they should be '*experts*'.[8]

This begs the question as to whether videolaryngoscopy should be used solely as a rescue device or routinely. A 2012 UK survey reported that only 57% had access to videolaryngoscopes.[10] By 2017, the vast majority of UK hospitals had videolaryngoscopes, but access was often restricted to the main operating theatre suite and absent in many clinical settings.[14] Critically, routine use was reported in fewer than one-third of hospitals and was sometimes restricted to specified individuals, training was often inadequate, and attitudes to use of videolaryngoscopy were inconsistent.

Having videolaryngoscopes immediately available to all practitioners and adopting them into routine practice benefits the patient and facilitates acquisition of competence and expertise. Education is facilitated, in real time and through recorded images, and airway team communication and teamwork are improved.[15,16] Routine use of videolaryngoscopy therefore improves institutional, team, and individual preparedness for managing intubation difficulty.

## Plan B and limiting choice

The relationship between choice and outcome/decision-making is a complex one. Counterintuitively, higher levels of information and more choice do not always result in better outcomes.[17] 'Choice overload' is a term used outside medicine to describe situations where an increase in choice can result in delay in decision-making or the inability to decide or take action at all,[18] and which may be more profound when time is limited.[19] The concept of 'fast-and-frugal' decision-making within medicine has been studied in some detail.[17] Using problem-focused decision-making tools, clinicians can make decisions rapidly, based on very little information (or choice), producing results comparable to those made by complex models with multiple variables.[17] These concepts could usefully be extended to the equipment we use. By limiting available airway equipment—and therefore choice—to that known to be most likely to achieve success in a crisis, we can improve decision-making and 'algorithm transitioning'. In addition to this technical benefit, the whole team will be more likely to be aware of and familiar with the equipment required for transitioning to the next step.

The emphasis of Plan B in the 2015 DAS guidelines is on maintaining oxygenation using a supraglottic airway (SGA) device.[8] SGAs have been in routine use for more than 30 yr. Whilst first-generation devices are effective in selected cases, they have limitations. Second-generation devices, such as the ProSeal laryngeal mask airways and i-gel, largely address these limitations with modifications that improve airway seal and reduce risk of pulmonary aspiration. Although definitive evidence of improved safety is lacking, this is likely because of the impracticality of such research, which would require several million patients to prove the point. Using weighted scores across several domains of safety and efficacy based on available 'all source' evidence, second-generation SGAs were calculated to outperform their predecessors in all areas of practice, and particularly for airway rescue.[20]

The 2015 DAS guidelines recommend second-generation SGAs as rescue devices.[8] This was reinforced in the 2018 guidance for airway management of the critically ill.[21] If both first- and second-generation SGAs are available when difficulty is encountered, the practitioner must actively weigh the benefits and limitations of each before choosing one device. A more inexperienced practitioner may make the incorrect choice or lose precious time while deciding. Even when the correct decision is made, this may not be anticipated by the assistant, adding further delay. If instead only one or two second-generation SGAs are available, both for routine use and as a rescue device, then in a crisis situation not only is the correct equipment immediately available but practitioners are practised and skilled in their use, delays in crisis decision-making are minimised, assistants are more likely to anticipate correctly, and algorithm transitioning is enhanced. Here again, by reducing the choice of available airway equipment, an organisation will not only improve institutional preparedness, but also the preparedness of the team and individual clinicians.

## Plan D and standardisation

Industry has applied standardisation of processes and equipment for many years to improve efficiency. More recently, human factors and ergonomic research in healthcare has highlighted the importance of standardisation of equipment in reducing human errors and improving safety.[22] Standardisation may refer to any aspect of the equipment, from the model and functionality, to the location where it is kept and how it is cleaned or disposed of. Whilst it may initially be unrealistic to expect national standardisation, this should certainly be possible in an individual hospital, and regional networks may facilitate this more widely.[23] Because clinicians, especially trainees, move frequently between different hospitals and even between different departments within hospitals, such equipment standardisation has obvious potential to improve familiarity, confidence, and competence, and thereby engender a culture of safety.

When attempts to manage the airway by tracheal intubation, mask ventilation, and SGA have failed, a cannot intubate-cannot oxygenate situation arises that necessitates an emergency front-of-neck airway (eFONA) according to Plan D of the DAS

guidelines.[8] While the approach to the emergency front-of-neck airway (eFONA) has not been standardised across the UK, major steps in that direction have been taken. The NAP4 recommended that a surgical cricothyroidotomy approach be taught to all anaesthetists,[2] and the 2015 DAS guidelines recommended a scalpel-bougie-tube approach as the default technique.[13] Both emphasised universal training and a single approach within any one hospital. This has been further emphasised in cross-specialty documents.[24] Although rarely used, eFONA equipment, when needed, must be immediately available and the team familiar with and confident in its use in order to save a life *in extremis*.[2] Delay in performing eFONA is likely to be a greater cause of harm than procedural complications. Despite this, a small UK survey reported that more than one in four anaesthetists could not confirm that an eFONA kit was available in their institution.[25] Conversely, a survey of Australasian anaesthetic departments reported immediate availability and visibility of point-of-care eFONA equipment in >80% of operating theatres, though this was the case in only around half of satellite locations.[26] Current UK practice is unknown.

Following the evidence is possible. Reducing choice is possible. Standardisation is possible. Mandating training is possible. In our hospital we have done all these. Videolaryngoscopy is used universally and after 5 yr we believe that we are still learning new skills and benefitting our patients.[27] We removed all first-generation SGAs from use 3 yr ago (except for flexible laryngeal masks for head and neck surgery) and have only two types of second-generation SGA available for routine (and rescue) use. Point-of-care eFONA kits (a scalpel, a bougie, and a tracheal tube) are boxed and available in every location where anaesthesia takes place. Workshop-based airway training, which includes training in use of all the equipment described in this editorial and all techniques necessary in the 2015 DAS algorithms, was made mandatory for all anaesthesia and intensive care department members 4 yr ago, with 100% compliance. When airway difficulty arises in clinical practice, the equipment deployed is instantly available, and is that which is in routine use and with which we and our assistants are trained, familiar, and skilled or expert. Introducing these changes in practice was not without barriers, but we firmly believe that it has improved the standard and reliability of airway management throughout the hospital and improved patient care. It has reduced the frequency of airway crises with no eFONA performed in 6 yr. We would not wish to return to previous non-standardised approaches.

## Reflections on airway management during the COVID-19 pandemic and implications for the future

The COVID-19 pandemic has brought the reliability of airway management techniques into sharp focus, both to improve patient safety and to protect the health of the intubating team. Amongst four COVID-specific airway management guidelines from across the globe, institutional preparedness is emphasised and both universal use of videolaryngoscopy and second-generation SGAs are recommended by all.[28–31] All emphasise limiting choices and use of techniques that are reliable and with which the operator is trained.[28–31]

Together the COVID-19 guidelines encapsulate the concepts discussed above. They advocate for safe, accurate, and swift airway management.[28] This cannot be achieved without institutional, team, and individual preparedness. Equipment standardisation and routine use of equipment that will be used in an emergency is a logical central component of each of these goals. In the short term it is likely that severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2) will be an endemic infection and the need to ensure safe, accurate, and swift airway management with remain. It is quite possible airway management will have been changed forever. We will watch with interest to learn what lessons the airway community has learnt from the SARS-CoV-2 pandemic, but the above principles offer a template for safe practice now.

## Authors' contributions

Contributed to the ideas, drafting, and finalising of this editorial: all authors.

## Declarations of interest

TMC is an associate editor of the *British Journal of Anaesthesia*. MG and FEK have no conflicts to declare.

## References


1. Baker P. Preparedness and education in airway management. *Anesthesiol Clin* 2015; **33**: 381–95
2. Cook TM, Woodall N, Frerk C. Major complications of airway management in the UK: results of the 4th national Audit Project of the royal College of anaesthetists and the difficult airway society. Part 1 anaesthesia. *Br J Anaesth* 2011; **106**: 617–31
3. Annex D. Royal College of anaesthetists 2010 curriculum. Available from: https://www.rcoa.ac.uk/sites/default/files/documents/2019-08/TRG-CCT-ANNEXD.pdf (accessed 22 May 2020).
4. Emergency response Activities. *Australian and New Zealand College of anaesthetists* 2020. Available from: http://www.anzca.edu.au/fellows/continuing-professional-development/emergency-response-activities. [Accessed 18 May 2020]
5. Kelly FE, Duggan LV. Preparing for, and more importantly preventing, 'cannot intubate, cannot oxygenate' events. *Anaesthesia* 2020; **75**: 707–10
6. Lindkær-Jensen NH, Cook TM, Kelly F. A national survey of practical airway training in UK anaesthetic departments. Time for a national strategy? *Anaesthesia* 2016; **71**: 1273–9
7. Charlesworth JD, Warren TL, Brainard MS. Covert skill learning in a cortical-basal ganglia circuit. *Nature* 2012; **486**: 251–5
8. Frerk C, Mitchell VS, McNarry AF, et al. Difficult Airway Society 2015 guidelines for management of unanticipated difficult intubation in adults. Difficult Airway Society intubation guidelines working group. *Br J Anaesth* 2015; **115**: 827–48
9. Lewis SR, Butler AR, Parker J, Cook TM, Schofield-Robinson OJ, Smith AF. Videolaryngoscopy versus direct laryngoscopy for adult patients requiring tracheal intubation: a Cochrane Systematic Review. *Br J Anaesth* 2017; **119**: 369–83
10. Gill RL, Jeffrey ASJ, McNarry AF, Liew GHC. The availability of advanced airway equipment and experience with videolaryngoscopy in the UK: two UK Surveys. *Anesthesiol Res Pract* 2015; **2015**: 152014. https://doi.org/10.1155/2015/152014
11. Greaves JD. Training time and consultant practice. *Br J Anaesth* 2005; **95**: 581–3
12. Cortellazzi P, Caldiroli D, Byrne A, Sommariva A, Orena EF, Tramacere I. Defining and developing expertise in

tracheal intubation using a GlideScope® for anaesthetists with expertise in Macintosh laryngoscopy: an in-vivo longitudinal study. *Anaesthesia* 2015; **70**: 290–5
13. Cook TM, Boniface NJ, Seller C, et al. Universal videolaryngoscopy: a structured approach to conversion to videolaryngoscopy for all intubations in an anaesthetic and intensive care department. *Br J Anaesth* 2018; **120**: 173–80
14. Cook TM, Kelly FE. A national survey of videolaryngoscopy in the United Kingdom. *Br J Anaesth* 2017; **118**: 593–600
15. Howard-Quijano KJ, Huang YM, Matevosian R, Kaplan MB, Steadman RH. Video-assisted instruction improves the success rate for tracheal intubation by novices. *Br J Anaesth* 2008; **101**: 568–72
16. Zaouter C, Calderon J, Hemmerling TM. Videolaryngoscopy as a new standard of care. *Br J Anaesth* 2015; **114**: 181–3
17. Marewski JN, Gigerenzer G. Heuristic decision making in medicine. *Dialogues Clin Neurosci* 2012; **14**: 77–89
18. Scheibehenne B, Greifeneder R, Todd P, et al. Can there ever be too many options? A Meta-analytic review of choice overload. *J Consum Res* 2010; **37**: 409–25
19. Jessup RK, Ritchie LE, Homer J. Hurry up and decide: empirical tests of the choice overload effect using cognitive process models. *Decision* 2020; **7**: 137–52
20. Cook TM, Kelly FE. Time to abandon the 'vintage' laryngeal mask airway and adopt second-generation supraglottic airway devices as first choice. *Br J Anaesth* 2015; **115**: 497–9
21. Higgs A, McGrath BA, Goddard C, et al. Guidelines for the management of tracheal intubation in critically ill adults. *Br J Anaesth* 2018; **120**: 323–52
22. Care Quality Commission. Supporting note: standardisation. Available from: https://www.cqc.org.uk/sites/default/files/documents/20110506_supporting_note_-_standardisation_updated_for_external_publication.pdf (accessed 25 February 2020).
23. McNarry A, Cook TM, O'Sullivan EP, Baker PA. The airway lead – opportunities to improve institutional and personal preparedness for airway management. *Br J Anaesth* 2020; **125**: e22–4
24. Pracy JP, Brennan L, Cook TM, et al. Surgical intervention during a can't intubate can't oxygenate (CICO) event: emergency front-of-neck airway (FONA)? *Br J Anaesth* 2016; **117**: 426–8
25. Mendonca C, Ahmad I, Sajayan A, et al. Front of neck access: a survey among anesthetists and surgeons. *J Anaesthesiol Clin Pharmacol* 2017; **33**: 462–6
26. Rehak A, Watterson L. Institutional preparedness to prevent and manage anaesthesia-related 'can't intubate, can't oxygenate' events in Australian and New Zealand teaching hospitals. *Anaesthesia* 2019; **75**: 767–74
27. Saunders TG, Gibbins ML, Seller CA, Kelly FE, Cook TM. Videolaryngoscope assisted fibreoptic intubation for tracheal tube exchange in a difficult airway. *Anaesth Rep* 2019; **7**: 22–5
28. Cook TM, El-Boghdadly K, McGuire B, McNarry AF, Patel A, Higgs A. Consensus guidelines for managing the airway in patients with COVID-19. Guidelines from the difficult airway society, the association of anaesthetists the intensive care society, the faculty of intensive care medicine and the royal College of anaesthetists. *Anaesthesia* 2020; **75**: 785–99
29. Sorbello M, El-Boghdadly K, Di Giacinto I, et al. The Italian coronavirus disease 2019 outbreak: recommendations from clinical practice. *Anaesthesia* 2020; **75**: 724–32
30. Brewster DJ, Chrimes N, Do TB, et al. Consensus statement: safe Airway Society principles of airway management and tracheal intubation specific to the COVID-19 adult patient group. *Med J Aust* 2020; **212**: 472–81
31. Yao W, Wang T, Jiang B, et al. Emergency tracheal intubation in 202 patients with COVID-19 in Wuhan, China: lessons learnt and international expert recommendations. *Br J Anaesth* 2020; **125**: e28–37

*British Journal of Anaesthesia*, 125 (3): 224–226 (2020)
doi: 10.1016/j.bja.2020.05.053
Advance Access Publication Date: 9 July 2020


# Preoperative evaluation in 2020: does exercise capacity fit into decision-making?

Lee A. Fleisher

Department of Anesthesiology and Critical Care, Perelman School of Medicine of the University of Pennsylvania, Philadelphia, PA, USA

E-mail: lee.fleisher@uphs.upenn.edu

This editorial accompanies: Integration of the Duke Activity Status Index into preoperative risk evaluation: a multicentre prospective cohort study by Wijeysundera et al., *Br J Anaesth* 2020:124: 261–70, doi: 10.1016/j.bja.2019.11.025

DOI of original article: 10.1016/j.bja.2019.11.025.