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Editorial

The myth of the difficult airway: airway management revisited

If you always do what you've always done, you'll always get what you've always got

—Henry Ford

For years, anaesthetists have tried to predict the difficult airway using various clinical signs and prediction models. In this issue of *Anaesthesia*, Nørskov et al. present a study of a large cohort of 188 064 patients in Denmark and come to a disappointing conclusion: we are not good at it [1]. Of 3391 difficult intubations, 3154 (93%) were unanticipated. When difficult intubation was anticipated, only 229/929 (25%) had an actual difficult intubation. Difficult mask ventilation was unanticipated in 808/857 (94%) cases.

Should these findings surprise us? Probably not, because we try to predict the probability that our airway management technique will be effective and safe in a particular patient. How to do that with so many options? Following pre-oxygenation for 3 min or with three deep inhalations, using 80% or 100% inspiratory oxygen, we can induce general anaesthesia intravenously or with volatile anaesthetics, use ten different facemasks for bag-mask ventilation, using one or two hands with or without an oropharyngeal airway, with or without cricoid pressure, in the half-sitting or supine position. Should we choose direct laryngoscopy we have thirty different blades and if we use a videolaryngoscope there are fifteen different models, with at least six different blades – disposable or re-usable, angulated or hyper-angulated. Subsequently, twenty different tracheal tubes are available in all sizes and with variously shaped cuffs, made from different materials and introduced through the vocal cords nasally or orally with eight different stylets or bougies. Should we decide to perform fibreoptic intubation we could do that face-to-face or standing behind the patient, awake or anaesthetised, with or without sedation and looking through the 'scope's eyepiece or using a monitor screen. Should we unexpectedly end up in a 'cannot intubate cannot oxygenate' situation (CICO), there are fifteen different supraglottic airway devices with or without a gastric suction channel. Ultimately, when the going gets tough, our team can perform an emergency surgical airway with several devices and techniques [2, 3].

All this illustrates that we probably can select more than a million different ways to oxygenate a patient; not surprising, therefore, that it is difficult to predict success with so many options. Nørskov et al. should be applauded for sharing their results, as they clearly show that the answer is not found by doing it the same way with big numbers. This is what can be learnt from their study and from opinions of others: we may need a different approach [4].

In our opinion, the 'difficult airway' does not exist. It is a complex situational interplay of patient, practitioner, equipment, expertise and circumstances. Not that we wish to trivialise the concept of the difficult airway; failed intubation and its associated complications can cause serious patient harm. However, the incidence and the definition of the difficult airway, difficult laryngoscopy and difficult intubation are not well defined. Cook and MacDougall-Davis recently summarised that CICO has an incidence of 1:50 000 and failed intubation occurs in 1:2000 elective cases, but up to 1:200 in emergencies [5]. Rocke et al. reported difficult intubation in 7.9%, and very difficult intubation in 2%, of parturients undergoing general anaesthesia for caesarean section [6]. In a mixed surgical population, Rose et al. noted that 2.5% of patients required two laryngoscopies to achieve tracheal intubation and that 1.8% required more than three [7]. This suggests that difficulty with intubation occurs more frequently during obstetric anaesthesia, but that the frequency of *very* difficult intubation is similar in obstetric and non-obstetric surgical populations. Further, that these numbers haven't changed over the years.

Furthermore, if we use the well-known definition for the difficult airway endorsed by the American Society of Anesthesiologists: "*a clinical situation in which a conventionally trained anaesthesiologist experiences difficulty with face mask ventilation of the upper airway, difficulty with tracheal intubation or both*", it will unfortunately not make a clear difference for clinical practice [2]. A global competence profile of the 'conventionally trained anaesthesiologist' does not exist and according to the definition, the clinician can only find out whether a patient has a 'difficult airway' after intubation has failed.

Documentation of tracheal intubation

All airway management guidelines recommend pre-operative airway evaluation, which often requires patient data from previous surgery. However, accurate documentation of the intubation procedure is often ignored and standardisation of airway management documentation is still lacking. A flaw in airway management research is that much research into videolaryngoscopy still relies on the Cormack and Lehane score, which is not its intended use [8]. Moreover, differentiation between Cormack and Lehane grades 2 and 3 is not easy, even amongst well-trained professionals though the division of grade 2 into

2a/2b may help [9]. The percentage of glottic opening visible (POGO) may perhaps be preferable for documentation of videolaryngoscopy, although this too is not perfect since in order to give an accurate percentage, one has to see the whole glottis, which by definition may be impossible [10]. The bottom line is that if input data are incorrect because of improper documentation or imprecise scoring systems, the outcomes of prediction models will be unreliable.

Prediction models

Using a three-tier classification, Mallampati et al. reported difficult direct laryngoscopy in the majority of patients with a poor view of the pharyngeal structures [11]. Samsoon and Young reviewed a series of patients with known difficult intubation and added a fourth class (no pharyngeal structures seen): in patients with difficult laryngoscopy, classes 3 and 4 predominated [12]. Unfortunately, subsequent evaluations showed that Mallampati/modified Mallampati scores poorly predict difficult intubation [13–16]. Wilson et al.'s model, based on grading patients' weight, head and neck movement, jaw movement, mandibular size and prominence of the upper incisors, predicted difficult intubation with sensitivity of 75% and specificity of 88% [17]. In parturients undergoing caesarean section, Rocke et al. utilised the modified Mallampati classification combined with other characteristics (short neck, obesity, missing/protruding maxillary incisors, single maxillary tooth, facial oedema, swollen tongue and receding mandible) [6]. An easy, first-attempt intubation occurred in 96% of class-1 airways, 91% of class-2, 82% of class-3 and 76% of class-4 airways. Surprisingly, most class-4 airways were not difficult to intubate, and only 4-6% of class-3/4 airways were considered to be very difficult intubations. The following emerged as aetiological factors predicting difficult or failed intubation: airway class 2 (RR 3.23); airway class 3 (RR 7.58); airway class 4 (RR 11.30); short neck (RR 5.01); receding mandible (RR 9.71); and protruding maxillary incisors (RR 8.0). Obesity and a short neck were linked factors, with obesity being eliminated as a risk factor if short neck was excluded [6].

Although the value of airway assessment in itself is acknowledged, most experts in the field conclude that simple and practical strategies may have a high sensitivity but a low specificity and positive predictive value [18–20]. However, in current scoring systems, non-patient related factors that may complicate airway management and threaten patient safety are missing: experience; time pressure; available equipment; location; and human factors [21, 22].

Debunking the myth

While it can be concluded that airway management is a highly complex procedure, the 'difficult airway' does not exist, in our opinion. A previously healthy patient, whose airway is scored as Mallampati class 1 and whose trachea can be intubated with basic airway management skills, may become 'difficult' when he presents in septic shock and with a low oxygen saturation, to an emergency physician in a remote hospital who performs only ten tracheal intubations a year. The lack of experience, time pressure and severity of illness may render this 'basic' airway more complex, while an intensivist in a busy metropolitan hospital may have no problem at all. In contrast, a Mallampati class-4 airway can represent a routine intubation for an anaesthetist experienced in awake intubation, even after major head and neck surgery with free flap reconstruction. For these doctors, the definition of a difficult airway will be different, and accurate prediction of intubation problems is impossible with current methods.

It seems that we work intuitively and become sensitive to subtle warning signs of possible airway danger (e.g. presence of hoarse voice or the size of a tumor in patients with head and neck cancer), that may not be included in routine airway assessment. While this experience evolves according to our share of failed intubations (expected and unexpected), the less experienced doctor must also be able to differentiate between a normal and a potentially challenging airway. We would propose a more careful balance between patient related factors and airway management skills. 'Complexity factors', a term that is commonly used to describe contributory factors in behavioural, technical, economic and other systems, that may add to the complexity of the procedure, should be identified and weighed as well (Table 1) [23]. Moreover, as argued above, airway management is sensitive to both context [24] and time (and therefore to 'plan continuation error' [25]). The initial airway management plan, seemingly clear and rock solid in the beginning, could

Table 1 Complexity factors that may be a threat to patient safety during airway management, arranged according to a 'HELP-ET' checklist.

Factor	Example(s)
Human factors	Language barrier, fatigue, stress
Experience	Lack of skills (e.g. flexible awake intubation is needed but the team has never done this procedure)
Location	Remote hospital, no expert help available
Patient factors	Prior radiation therapy to the neck, airway obstruction
Equipment	Technical problems
Time pressure	Rapid desaturation, unstable vital signs

prove wrong if the situation is rapidly changing; for example, if a tumour starts bleeding during intubation, the videolaryngoscope may no longer be useful and may have to be exchanged for another device that is independent of good vision. If we ignore the warning signs during intubation that we need to change our strategy, the risk for potentially severe complications increases considerably. Experience and training increase awareness and prevent the potential pitfall of plan continuation error, which has been recognised as an important factor in aviation crashes. Another important observation from previous studies is the fact that if one airway management technique is difficult or fails, the risk of other techniques' being difficult or failing is considerably increased: this is defined as 'composite failure' of airway management [6].

Basic and advanced airways

A classification system should be used that can decrease the risk of continuation error, prevent composite failure, and frames the context of airway management with respect to potential complexity factors. It should be able to differentiate clearly between normal and challenging airways, and ideally be independent of clinical experience. We propose a different approach to the classic distinction into non-difficult versus difficult airway management: basic versus advanced. We suggest that this reflects the learning that comes with many years' experience, of which airways are easily managed with standard techniques in a controlled clinical environment, and which aren't. Every patient should be assessed in the same way before airway management (Fig. 1).

The basic airway (Table 2)

In a patient with a basic airway, there are no complexity factors and management of the airway can be completed without time pressure, within a minute, by a well-trained medical person. Without complexity factors, bag-mask ventilation, supraglottic airway device insertion and direct laryngoscopy with a standard laryngoscope blade are all expected to be successful [20]. Even emergency and postoperative management is likely to present few real challenges because the anatomy is normal and the surgical procedure has been performed outside the respiratory tract.

Most of our patients will have basic airways. In the rare event of unexpected difficulties, it should be possible to call for help early and/or to wake up the patient, without undue risk. Some experts opine that airway management should be standardised to increase safety [26]. That could possibly be done with basic airways.

All other airways that do not meet these criteria can be classified as advanced airways.

The advanced airway

In patients with advanced airways, it must be anticipated that airway

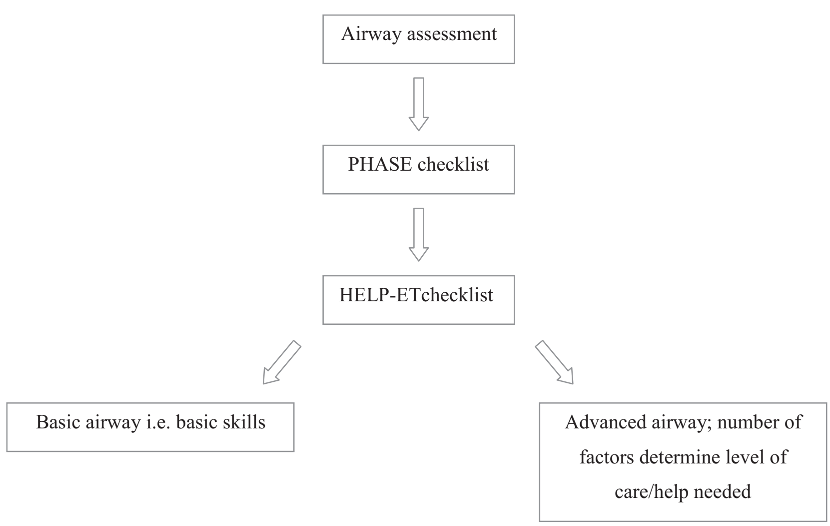

Figure 1 Assessment plan for all patients presenting for airway management.

Table 2 Requirements for a classification of a basic airway, arranged according to a 'PHASE' checklist.

Patient*	ASA physical status 1-2 Age > 12 years Cooperative BMI < 25 kg.m^{-2} Height > 130 cm < 200 cm Weight > 30 kg < 100 kg Airway management in hospital environment
History	No prior history of airway management complications or problems No prior reconstructive surgery and/or radiation therapy to upper airway or neck No medical syndrome that is associated with airway management problems
Airway	Mallampati 1–2 with mouth opening > 3 cm No loose teeth or buck teeth Good neck flexion and extension (> 5 cm movement from tip of chin to sternal notch) No large beard that makes face mask oxygenation problematic No short neck (thyromental distance > 4 cm) No tumors or lumps in upper airway or neck region No active bleeding in the upper airway No inspiratory stridor
Surgical procedure	Outside upper airway or neck region
Evaluation of vital signs	Saturation at start of procedure without supplemental oxygen > 95% Stable vital signs: systolic arterial pressure > 95 mmHg; heart rate 40–140 beats.min^{-1}; respiratory rate 14–20 breaths.min^{-1}

*Pregnant patients will most probably have BMI > 25 kg.m^{-2} and are often classified as advanced airways.

management can be challenging, because of the presence of one or more of the aforementioned complexity factors. In these cases, special measurements or advanced skills may be needed, for example the immediate availability of a dedicated airway management trolley or, in cases with many complexity factors, the help of an airway management expert and/or head and neck surgeon.

There is a distinction between the paediatric and adult airway. For our classification, paediatric is defined as children younger than 12 years; above this, dentition should be permanent and most patients will not have loose teeth that might otherwise present a problem during airway management.

An advanced airway could be further classified according to the number and type of complexity factors, as in Table 1. Thus, for example, 1E would indicate one complexity factor present in the category Experience, while 3HPT would be an advanced airway with three complexity factors (Human factors, Patient factors, Time pressure).

In the 4th National Audit Project (NAP4), the following complexity factors were strong predictors for complications: body mass index (Patient factors); head and neck conditions (Patient factors); absence of capnography (Equipment factors); communication problems (Human factors); out of theatre location (Location); and wrong emergency surgical technique (Experience, Time pressure) [27].

Conclusions

We suggest that the term 'difficult airway' has been a cause of confusion and that we should start redefining airway assessment and management. We propose that airway assessment should focus on differentiating between the basic and advanced airway. Further research should evaluate the factors that cause complexity and therefore complications, and we can move away from doing what we've always done.

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Editorial

If a little bit is wrong, how much is alright? Interpreting the significance of small numerators in clinical trials

A clinician colleague reports no failures in the last 20 intubation attempts using a new device and suggests this is satisfactory evidence of efficacy. However, a true population failure rate up to and including 14% would produce zero failures in 20 patients at least 5% of the time, lending some doubt to the claim of a 100% success rate. While statistical programs can calculate an exact 95% confidence interval in this setting, an easy approximation is to use the 'rule of three' (ROT) as suggested by Hanley and Lippman-Hand [1] in an

