Risk and airway management

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Factors affecting risk behaviour

Medicine is a risky business; anaesthesiology maybe more so than most specialties. How anaesthetists make decisions about patient care is affected by their attitudes to risk and safety. However, how people perceive and react to risks depends on many personal psychological factors [1]; among these are the anaesthetist's personality type. People can be categorised according to their behavioural response to risks. There are three basic types: risk takers, risk avoiders, and those who are risk neutral. Humans are also prone to a large number of cognitive biases, many of which are dealt with in an excellent review by Stiegler and colleagues [2]. Common ones include:

'Availability' bias. The likelihood of rare, catastrophic or dramatic events is magnified according to the ease with which instances of similar events can be recalled; memorable events seem more common.

Compression bias. Deaths due to rare unusual or dramatic causes (e.g. floods, tornadoes) are perceived to be more frequent, whereas common killers such as heart disease are perceived to be less common than they really are.

Miscalibration bias. Individuals tend to be overconfident about the extent and accuracy of their knowledge, which tends to desensitise them to the risks concerned.

Representativeness bias. Individuals tend to believe that the specific risks for them are significantly less than they really are. For instance, a cigarette smoker might downgrade the risks of smoking because their parents were lifetime smokers and remain healthy. This also has to do with another psychological trait, which is how vulnerable – or invulnerable - people feel to risk in general.

However, not only the psychology of the individual, but also peoples' social and cultural environment, can influence how they respond to risk and safety. Many industries, such as aviation, nuclear power and engineering, are risky and should have many accidents, but do not. These enterprises have been termed 'high reliability organisations' and typically show unsafe processes made less unsafe by the attitudes of staff and the construction of safety-promoting systems of work.

Healthcare professionals' understanding of risk-taking

The title of this section is taken from a paper we published in 2010 [3]. It reports research we did into healthcare professionals' understanding of risk and safety in their work, using a qualitative approach within a social psychology framework. We conducted semi-structured interviews with 48 healthcare workers of various professional groups including doctors, nurses, physiotherapists, pharmacists, ward clerks and hospital managers. We found five main themes within the data [4]:

1 The definition of risk. Here, respondents made the distinction between 'professional' risk, by which they meant risks evoked by their actions, mitigated by training and experience; and 'situational' risk, which they saw as arising from the hospital setting, the environment in which their actions take place.

2 'Risk free is unattainable'. Respondents took the view that the idea that the risks associated with healthcare can be completely controlled or eradicated was impossible, a sort of unattainable utopia, suggesting that some level of risk was inevitable.

3 Acceptability of risk. Participants drew the distinction between 'acceptable' and 'unacceptable' risks within their working lives. This was not in itself surprising, but the process of distinguishing between 'acceptable' and 'unacceptable' seemed to depend on an ad *hoc*

calculation of perceived benefits involved in taking a particular risk against the perceived benefit of not taking that risk. In other words, taking risks brings benefits too.

4 Factors influencing risky decisions. There were 'vertical' differences between senior and junior members of the same professional group, but also 'horizontal' differences between professional groups. Respondents viewed the former as the result of variations in the level of participants' experience and/or the quality of training. This was perceived as a cause for concern, not least because increasing seniority is not always associated with the most up-to-date knowledge. (The role of experience is therefore ambiguous, as it might reduce 'professional' risk but also appears to increase risk-taking behaviour.) Horizontal differences between groups in notions of safety and what it meant seemed to be related to how staff identified themselves as members of such groups. Further, participants valued the beliefs and practices from their own group more highly than those of other groups.

5 Finally, our interviewees talked about protocols and policies. Generaly they were sceptical about the effectiveness and efficiency of these, for two main reasons. First, some doubted their relevance to the everyday practice of front line staff since (as the majority of participants argued) these policies and protocols are designed by those who are not responsible for their implementation, and may not fit the practice context for which they are said to have been produced. Second, resource deficiencies were felt to make it difficult to follow policies and protocols.

To us, the most striking findings were firstly that seniority did not necessarily mean safer practice, and secondly that there are social influences within groups which help define what is considered safe or risky. Further, this seems to be independent of formal policies and guidelines.

When things go wrong……..

When things go wrong, they go wrong for a number of reasons. People make mistakes, because they do not know better, or because they have forgotten what they should know. Or they may be distracted and make slips, or 'lapses'. Or they may intentionally decide to 'break the rules' – so-called 'violations'. Often, this is because the workplace culture changes over time so that behaviour which is unacceptable gradually becomes 'normal'. This process is called 'migration' [5]. So, when the respondents talked about 'pulling themselves back' to safer practice, they are illustrating the 'migration' principle.

Risk-taking in airway management

Airway management is probably one of the riskiest activities which anaesthetists undertake. A recent review well summarises how the main complications can be prevented [6]. Thinking now about airway management, how might these factors affect our performance?

Within the Royal College of Anaesthetists' 4th National Audit (NAP 4) of airway complications, there are many instances of what is referred to as 'poor judgement' – for instance, using a laryngeal mask airway when a patient is at risk of regurgitation and aspiration of gastric contents. There is a separate 'human factors' chapter in the report, which highlights some of the cultural issues suggested above, 'peer tolerance of poor standards' and 'organisational and professional cultures which induce or tolerate unsafe practices' being among them [7]. Individual psychological factors such as overconfidence, a casual attitude to risk, and fixation error (failure to move to another solution to a given problem, even when it is obvious that the solution is not effective) are also mentioned. More about social and psychological factors was revealed in a later analysis of in-depth interviews with 12 anaesthetists who reported airway problems to the NAP4 [8]. Respondents stated that they valued the opportunity to talk in detail about their experiences; some described a 'recalibration' of their attitudes to risk after something had gone wrong. This ties in with what is known about risk-taking behaviour in general. A more recent study found a number of what were termed 'human factors' relevant to airway management [9]. The authors found three enablers: equipment location and storage; experience and learning; teamwork and communication. Five broad barriers were also identified: time and

resource limitations; teamwork and communication; equipment location and storage; experience and learning; insufficient back-up planning; and equipment preparation [9].

However, in the 'real world' of professional work in high-risk environments, the definition of what is 'legal' (within the 'rules') and what is a 'violation' is often not simple. Even experts disagree, as illustrated by a report in *Anaesthesia* where a number of international airway specialists were asked how they might manage a difficult airway problem [10].

'Awake' techniques in airway management*

Awake fibreoptic intubation has been considered the technique of choice when managing many types of predicted difficult airway. In principle, if a patient is maintaining the patency of their own airway, there is a margin of safety which is lost if general anaesthesia is induced before the trachea is intubated. Despite this, the Fourth National Audit Project of the Royal College of Anaesthetists (NAP4) reported that awake fibreoptic intubation was not used as the primary airway plan for many high-risk patients [11]. However, awake fibreoptic intubation is a complex skill requiring regular practice to maintain competence. It is easy to see how this potentially difficult task, performed on a high-risk patient group of patients, in departments where numbers of awake fibreoptic intubations may be low, may pose a problem; and in consequence, it is understandable that an anaesthetist might opt for a more familiar, but less appropriate, technique. It is of course also true that awake fibreoptic intubation is not suitable for intubation in all patients with airway problems, and it is not always successful; NAP4 demonstrated that it failed for a variety of reasons. Most commonly these were airway obstruction, lack of patient co-operation and difficulty recognising airway anatomy because of excess secretions, blood or suction failure [11].

NAP4 was published in 2011. However, anaesthetic practice is ever changing. In 2016, Ahmad and Bailey argued in this journal that awake fibreoptic intubation was becoming obsolete [12]. Later that year, reviewing the revised Difficulty Airway Society's (DAS) guidelines on difficult intubation, Marshall and Pandit suggested that *'if it is essential to maximise the first attempt success rate, and if it is the case that videolaryngoscopes yield higher success in visualising the glottis, then it follows that these should become first line devices in most if not all tracheal intubations'* [13]. A Cochrane systematic review of videolaryngoscopy compared with direct laryngoscopy in adults concluded that *'failed intubations were significantly fewer when videolaryngoscopy was used in participants with anticipated difficult airway.'* [14]. In addition to this, the recent DAS guidelines on intubation in critically ill adults acknowledge the role of videolaryngoscopy [15], stating that *'if difficult laryngoscopy is predicted then videolaryngoscopy should be considered from the outset'.* However, these publications deal largely with the management of intubation in patients who are anaesthetised. A recent systematic review compared awake videolaryngoscopy and awake fibreoptic intubation in patients with anticipated airway difficulty [16]. Using standard systematic review methodology, the authors included eight studies overall. One study could not be included in the quantitative meta-analysis [17], leaving data from 408 patients in the remaining seven trials for the primary outcome, which was the time taken to intubate the trachea.

*Much of this section is based on a recent editorial in Anaesthesia: Wilson WM, Smith AF. The emerging role of awake laryngoscopy in airway management. *Anaesthesia* 2018; 73: 1058-61.

These numbers are small, and no trial sequential analysis was performed to establish whether a sufficient number of patients were present to be confident about the findings [18]. Nevertheless, the results appear to show that awake videolaryngoscopy reduces the time to achieve intubation, and otherwise the techniques are broadly comparable.

Understanding the details of the techniques used is vital not only in making sense of the systematic review, but equally in translating the review's findings into clinical practice. All studies used a remifentanil infusion with or without midazolam boluses as sedation for both awake videolaryngoscopy and awake fibreoptic intubation, except for the earliest study which used fentanyl and midazolam. Where recorded, a Ramsay sedation score of 2-3 was targeted. This raises the question how 'awake' patients undergoing these procedures truly are. The

Ramsay sedation score describes patient's responses to sedation as a continuum' from level 1 where the patient is alert, anxious and agitated; to level 6, where the patient is unresponsive. It defines levels 1-3 as 'awake' and 4-6 as 'asleep' [19]. This binary awake/asleep description is simple, but deeper sedation may reduce the safety margin offered by nominally 'awake' techniques. It is also important to note that very high levels of anxiety can also increase risk due to the physiological response to stress and the potential reduction in patient compliance during airway management. This concept of a theoretical target for an 'awake' patient (i.e effective anxiolysis whilst the patient remains alert to their surroundings) perhaps highlights the benefits that target-controlled remifentanil infusions have provided in the management of these patients. All studies used topical lidocaine on the airway, adopting a range of techniques including: transtracheal injection [20]; nebulised lidocaine [21]; 'spray as you go' metered lidocaine spray [22]; and the 'Mackenzie technique' [23]. In this, lidocaine is injected into the side port of a standard i.v. cannula, directed into the airway through the mouth, connected to a supply of oxygen which then deposits the drug on the mucosa of the airway. Given the variety of such techniques, the number of different types of videolaryngoscope used and the types of patient included in the studies, it is no surprise that a high level of heterogeneity was present in the meta-analysis. In response to this, the authors downgraded their assessment of the quality of evidence for the primary outcome.

As mentioned above, the patient's experience must always be considered when an 'awake' airway management technique is used. When recorded, studies in the review that examined patient satisfaction found both techniques to be equally well received, with most patients rating their experiences as excellent [22], and hypothetically agreeing to the same technique again should they need awake intubation again [24]. In addition, although the primary studies were not powered to detect a difference in complications, there were no major problems. Levels of failed intubation, nasopharyngeal bleeding, sore throat, hoarseness and minor respiratory/cardiovascular compromise were rare in both groups and, perhaps predictably, not significantly different between them. Again, the details of technique - not simply what is done, but how it is done - are important in reducing complications.

Thus awake videolaryngoscopy seems to be probably faster, and at least as safe, as awake fibreoptic bronchoscopy. The 'big screen' offered by awake videolaryngoscopy allows improved spatial awareness and a larger field of view, aiding the recognition of airway anatomy and direct observation of actions in the airway, such as application of local anaesthetic and suction. It avoids the 'red out' phenomenon which can occur with the fibrescope, where the tip of the fibrescope is pressed against tissue or debris in the airway. It also allows the passage of the tracheal tube through the vocal cords to be observed externally, which may be an advantage as this may be a 'sticking point' even when the fibrescope itself has been successfully passed through the cords. The upper airway can be examined after tube placement, which can be helpful in cases where the risk of bleeding is high, such as when there is a tumour in the upper airway.

The presence of a fibrescope within the tracheal tube can also cause the 'cork in the bottle' effect sometimes seen in awake fibreoptic intubation. The sudden increase in impedance to air flow as the tube passes the vocal cords can cause dyspnoea and anxiety. Again, this is not a problem with awake videolaryngoscopy. Related to this is the ability to select different diameters of tracheal tube with awake videolaryngoscopy, especially useful when a narrow microlaryngoscopy tube is needed. Finally, gentle traction with the videolaryngoscope can create more space in the airway; this can be useful when an obstructing lesion is present, or obesity compresses airway structures.

Of course, no single airway management technique can be used for every patient. Videolaryngoscopy cannot be used when mouth opening is limited, and as such these patients were excluded from the studies in the review by Alhomary et al. [16]. In these cases, awake nasal fibreoptic intubation is still essential. However, awake videolaryngoscopy would be entirely appropriate in patients with difficult mask ventilation [25] and in the obese, as complications are frequent in those with a higher body mass index [26]. Indeed, one of the studies included in Alhomary et al.'s review included only obese patients [22]. It is still unclear

what role awake videolaryngoscopy has in the role of suspected cervical spine injuries. One of the studies reviewed patients receiving elective cervical spine fixation, though the airway difficulty created by cervical immobilisation in patients with an acute spine injury might not be quite the same [21]. The UK Difficult Airway Society is currently preparing guidance on the use of awake airway management techniques, which we expect will be helpful in further defining the role of awake videolaryngoscopy. Anaesthetists, and in particular those in training, are finding videolaryngoscopy techniques of all kinds becoming more prevalent in their practice [27]. The benefits of videolaryngoscopy seem to be apparent when used by expert anaesthetists [28], but even medical students can be instructed in their use [29]. With higher levels of exposure and increasing use of videolaryngoscopy one can see how this can inspire them to adopt these techniques in 'awake' patients. However, the adoption of a novel technique which is potentially easier to master poses an obvious counterpoint. Fibreoptic intubation is already underused and there is the danger that the greater use of awake videolaryngoscopy further erodes clinicians' confidence and experience with awake fibreoptic intubation. Thus, although for most patients requiring awake intubation, awake videolaryngoscopy might come to offer a more familiar technique, it potentially further mystifies awake fibreoptic intubation and makes it even more of a rarity. Will this put patients for whom awake fibreoptic intubation is the only choice for airway management at risk? This utilitarian issue of changing practice for the greater good, whilst leaving a smaller number of patients potentially disadvantaged, poses an ethical conundrum. One should, however, be careful not to polarise the argument and suggest that the two techniques are mutually exclusive. They are not; they both have their uses, and in fact can be used, if necessary, simultaneously in the same patient to optimise both oropharyngeal view and guided tube placement.

There are a number of unanswered questions about the role of awake videolaryngoscopy in airway management. Could it be used instead of a rapid sequence induction in the non-fasted patient? Topical anaesthesia to the airway seems to be safe during awake fibreoptic intubation and the same should hold for awake videolaryngoscopy, though it would still be possible to apply cricoid pressure if this were thought necessary. In patients with cardiovascular disease, expert topical airway anaesthesia and videolaryngoscopic intubation should, in principle, avoid the need for an unpredictable drop in arterial pressure with the induction agent and a similarly undesirable rise in pressure and heart rate on tracheal intubation. As mentioned previously, would awake videolaryngoscopy be appropriate for patients in the Emergency Department, especially those with cervical spine injury? Further research is definitely required to resolve these questions.

What, then, are the implications for airway management policy and training? Whereas NAP4 recommended that *'all anaesthetic departments should provide a service where the skills and equipment are available to deliver awake fibreoptic intubation whenever it is indicated'* [11], Marshall and Chrimes have *'challenged the assumption that all anaesthetists need to possess the full range of technical skills for airway management',* suggesting instead that most anaesthetists should instead develop a *'more limited repertoire of 'core' techniques'* [30]. Whilst tracheal intubation is of course one of these techniques, they did not specify whether videolaryngoscopy might be used. Our personal opinion is that awake videolaryngoscopy should be a 'core' technique, and in fact would go further and reiterate the previously expressed view that awake intubation using a videolaryngoscope should be a primary technique for novice anaesthetists [31].

We think it is simple to learn and safe to perform and that trainees in anaesthesia should use it as a first-choice technique when a patient's airway is predicted difficult2. We would like to think that, by creating a technique for awake videolaryngoscopic intubation that is as simple and foolproof as possible, we can create a 'virtuous circle' where increasing confidence leads to further and wider use, and so on [31]. Our departmental 'recipe' for awake videolaryngoscopic intubation is appended.

In conclusion, guidelines and policies must have their place, and are assumed on balance to do more good than harm, but may not be applicable to every patient. We depend too on long-term

and acute psychological and social influences when we make decisions about patient care. Being aware of these, and how they can lead us to exercise 'poor judgement', and how we might improve our shared mental models and behaviour in teams [33] are important steps in improving safety.

Appendix

University Hospitals of Morecambe Bay

Guidelines for Awake Videolaryngoscopic Intubation

These guidelines are to assist in the technique of awake videolaryngoscopic intubation. Consideration must be made in each case about anticipated difficulty of ventilation, intubation and patient cooperation. Consider merits of awake vs. asleep technique or surgical technique.

Indications:

1. Known or anticipated difficult airway
2. Consider in obesity or obstructive sleep apnoea
3. Known/suspected cervical cord trauma or unstable neck (eg severe rheumatiod arthritis) and risk of aspiration

Contraindications:

1. Patient refusal/uncooperative patient
2. Care with periglottic masses- risk of developing complete airway obstruction or laryngospasm

Preparation:

Explanation of technique and consent

Drugs for inducing general anaesthesia when tracheal tube successfully in place.

Procedure:

Monitoring- Pulse oximetry/ECG/NIBP; capnography ready to attach

Oxygen e.g. 4 L/min via nasal sponge/nasal 'specs'

Sedation: remifentanil by target-controlled infusion; typically 0.1 – 0.15 microg.kg^{-1}.min^{-1} initially, increased as needed, whilst working on topical airway anaesthesia, to achieve a Ramsay sedation score of 2/3. Midazolam 1mg, or 20-30mg of propofol, can also be given for amnesia,

Topical airway anaesthesia:

1 Lidocaine 10m/kg metered spray to tongue and oropharynx: 10-15 sprays initially. 4% lidocaine can be used if available. Ask patient to gargle with liquid, then spit out. Repeat.

2 Insert Guedel airway to test adequacy of anaesthesia. If not, repeat spray and gargle once more

3 Insert videolaryngoscope. If anaesthesia not adequate, repeat spray and gargle.

4 Spray vocal cords under vision from 'scope. Inject 5ml 2% lidocaine either:

a) through a 10cm i.v. drip extension with mucosal atomisation device on end (MAD®, Medtree, Telford, UK)(see image) directed near larynx OR, if MAD not available,

b) tracheal tube placed in oropharynx until tip visible near vocal cords, then 18Ch suction catheter with proximal end cut off, inserted to protrude through the end of tube near larynx (Luer lock syringe fits this gauge of catheter).

If injections are timed to coincide with inspiration, lidocaine is drawn onto, and below, the cords.

5 Test laryngeal anaesthesia with gentle application of Yankauer sucker. If not adequate, repeat lidocaine spray to cords.
6 When adequate, advance tracheal tube through cords. Infraglottic anaesthesia is usually achieved by inhalation of lidocaine previously given higher in the airway.
7 Confirm intratracheal placement with capnography and induce general anaesthesia

Notes:

Maximum safe dose of lidocaine is taken to be about 8 $mg.kg^{-1}$ [4].

Nebulisation of lidocaine prior to theatre is possible but not thought to be effective and uses up some of the lidocaine allocation.

Glycopyrrolate 3-4 $\mu.kg^{-1}$ can be given i.v.; however, direct suction of secretions/ excess local anaesthetic is easy with the videolaryongoscope.

Ask patient to take deep breaths when tube approaching glottis to make passage easier.

Equipment checklist:

1. Remifentanil TCI pump
2. Midazolam/propofol
3. Videolaryngoscope
4. Guedel oropharyngeal airway
5. Tracheal tube, with stylet/bougie
6. Nasal oxygen sponge/ 'specs'
7. Metered dose lidocaine spray 10mg/ml
8. 2%/4% lidocaine
9. 10cm i.v. extension with mucosal atomisation device (MAD®)
10. 18Ch suction catheter with proximal end cut off

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