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Point of View

Emergency surgical airway in life-threatening acute airway emergencies – why are we so reluctant to do it?

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SUMMARY

'Can't intubate, can't oxygenate' scenarios are rare but are often poorly managed, with potentially disastrous consequences. In our opinion, all doctors should be able to create a surgical airway if necessary. More practically, at least all anaesthetists should have this ability. There should be a change in culture to one that encourages and facilitates the performance of a life-saving emergency surgical airway when required. In this regard, an understanding of the human factors that influence the decision to perform an emergency surgical airway is as important as technical skill. Standardisation of difficult airway equipment in areas where anaesthesia is performed is a step toward ensuring that an emergency surgical airway will be performed appropriately. Information on the incidence and clinical management of 'can't intubate, can't oxygenate' scenarios should be compiled through various sources, including national coronial inquest databases and anaesthetic critical incident reporting systems. A systematic approach to teaching and maintaining human factors in airway crisis management and emergency surgical airway skills to anaesthetic trainees and specialists should be developed: in our opinion participation should be mandatory. Importantly, the view that performing an emergency surgical airway is an admission of anaesthetist failure should be strongly countered.

Key Words: airway, obstruction, intubation, tracheostomy, education

Anaesthetists typically have considerable expertise in the prediction of difficult airways, but prediction is not 100% sensitive and unexpected difficulties occasionally arise[1]. There have been at least four coronial enquiries[2-6] since 2001 in Australia into deaths following 'can't intubate, can't oxygenate'[7,8] (CICO) scenarios. Summaries of these deaths follow.

Patient A died after drainage of a dental abscess under general anaesthesia in an operating theatre. Failure to maintain the airway occurred during induction, but no emergency surgical airway was performed.

Patient B died after surgical drainage of a dental abscess. This patient, who had been ventilated postoperatively overnight and then sent to the ward, died on that day on the ward from upper airway obstruction secondary to Ludwig's angina. Resuscitation included an unsuccessful attempted percutaneous tracheostomy and an emergency surgical airway that was undertaken too late to save the patient.

Patient C died after surgical drainage of a dental abscess. This patient was discharged from the post-anaesthetic care unit to the general ward, where

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airway obstruction developed. A cricothyroidotomy was attempted during the resuscitation, but was unsuccessful.

Patient D died two hours after surgical drainage of a dental abscess in the post-anaesthetic care unit. During resuscitation an unsuccessful attempt at cannula cricothyroidotomy was followed by a successful scalpel cricothyroidotomy, but this was too late to prevent hypoxic brain death.

In all these cases, hypoxia due to airway obstruction caused cardiorespiratory arrest, and successful resuscitation depended on achieving adequate oxygenation in time to prevent hypoxic brain damage. All four cases involved dental abscesses. Further research should be conducted on why this condition is prevalent in CICO scenarios.

The explanation for the failure to manage these CICO scenarios effectively may lie in part with how they typically develop. Consider:

- An anaesthetist performs a preoperative consultation for an anaesthetic on a patient to undergo surgery.
- An acute airway problem then develops unexpectedly some time after tracheal extubation.
- The anaesthetist feels a huge sense of personal responsibility for the situation.
- He or she must simultaneously diagnose and manage a rapidly deteriorating acute airway problem.
- At the same time, there is considerable anxiety, not only in regard to the safety of the patient, but also over the possible consequences, including loss of professional credibility and even legal action.
- During emergency airway crisis management, there is a strong tendency to fixate on intermediate objectives (such as intubation) that will, if achieved, return the situation to normal.

The focus should, instead, be on maintaining an objective overview of the situation ('situational awareness') and recognising the need for progression through a difficult airway algorithm[8,9] to provide oxygenation to save the patient's life, even if this requires creating an emergency surgical airway.

If any surgeon is present, then he or she is likely to have superior skills to an anaesthetist for performing an emergency surgical airway and should usually be asked to do this task. However, this is not always the case: for example, there has been a growing demand for 'off-site' anaesthesia in areas such as gastroenterology, bronchoscopy, interventional radiology and cardiology, where immediate access to a surgeon is unlikely. Furthermore, a recent survey of Western Australian surgeons showed that they perform surgical airways infrequently and only occasionally to assist anaesthetists with difficult airway management; they may also have little experience in crisis management in general, and difficulty in making a timely decision to proceed to a surgical airway[10]. Therefore, we believe that anaesthetists must be able not only to manage crises of this sort and to decide whether and when a surgical airway is needed, but also to carry out a surgical airway if necessary. Airway management is a core skill for any anaesthetist and expectations in relation to all aspects of airway management should be higher for anaesthetists than of most other doctors.

Unfortunately, such expectations may not always be well-founded. Confidence in the management of acute airway emergencies varies amongst anaesthetists[8] (as indeed it does among ENT surgeons[11]) and does not correlate with level of training. It is particularly concerning, therefore, that the anaesthetists in the coronial cases presented appeared to have difficulty maintaining adequate oxygenation where the only way of doing this effectively was by means of a timely emergency surgical airway. Instead, they persisted with repetitive attempts at tracheal intubation after these had become futile and an emergency surgical airway was urgently required. In retrospect it may seem obvious. It is worth asking why this might be so.

Gaba et al's flowchart[12] (Figure 1) summarises and highlights factors influencing the decision to perform an emergency surgical airway. These include the environment, the patient's presentation and the personnel.

Environmental factors include the available airway equipment and the situation in which the CICO scenario occurs. For example, an emergency surgical airway may be more likely to be performed in a military setting[13] than in private anaesthetic practice. The location has a direct impact on the anaesthetist's expectations and may be responsible, in part, for the poor transference of skills learnt in workshops to the clinical situation.

The presentation of the patient may influence the anaesthetist's decision to perform an emergency surgical airway. If a patient presents with torrential upper airway bleeding from severe facial injuries in a combat environment, these obvious visual clues may suggest an emergency surgical airway[13]. If, however, a similar patient has an undiagnosed lingual tonsil, the lack of an obvious cause for the problem may make an emergency surgical airway a less obvious decision.

Berlin et al[14] has identified five hazardous thought patterns in pilots (Table 1). Recognising and correcting these patterns is now an important part of aviation decision-making education. Similar thought patterns may occur in anaesthesia and influence our attitude to CICO management.

LIMITATIONS OF CURRENT TRAINING IN CICO MANAGEMENT AND EMERGENCY SURGICAL AIRWAYS

Reduced working hours of trainees over recent years has led to a reduction in clinical experience. The impact of this on patient safety has not

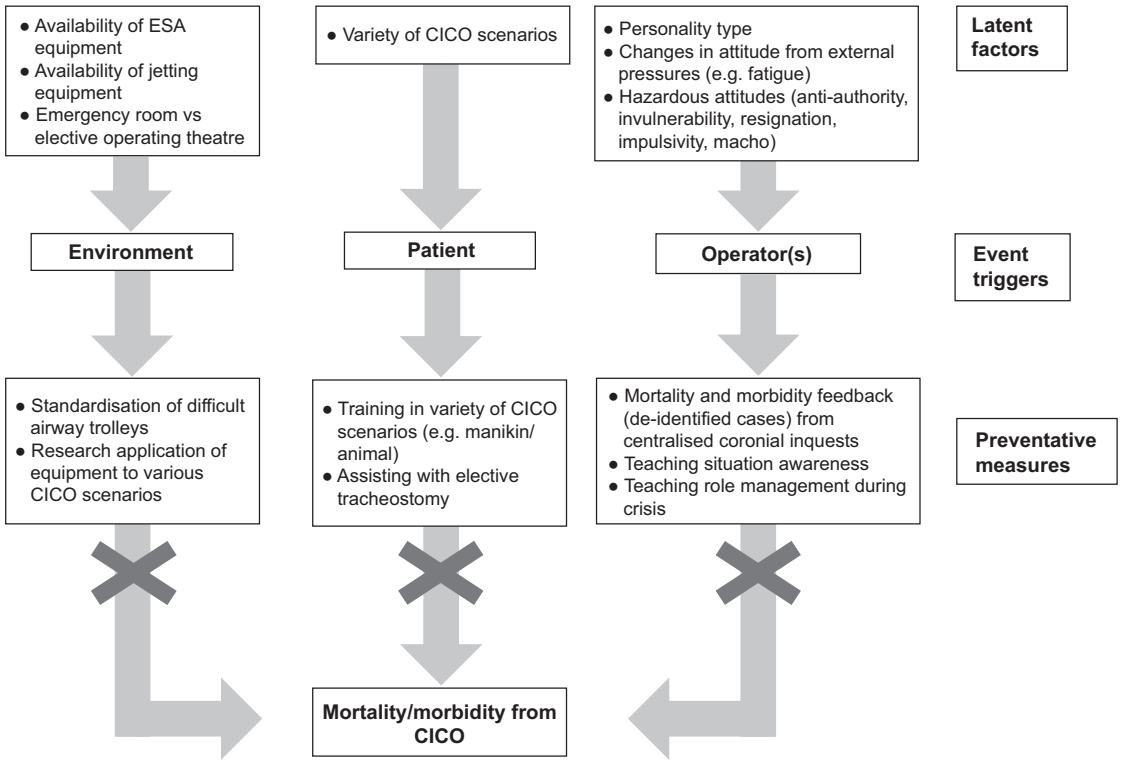

FIGURE 1: Factors influencing the occurrence of 'can't intubate, can't oxygenate' scenarios. (Modified from Professor David Gaba's original figure[12], with kind permission). ESA=emergency surgical airway, CICO='can't intubate, can't oxygenate'.

TABLE 1

Five hazardous thought patterns identified in the aviation industry that may adversely affect a pilot's decision in crisis management extrapolated to anaesthetists (based on Berlin et al[14]).

Hazardous attitudes	Description
Anti-authority ("Don't tell me")	Attitude that is resentful of rules, regulations, procedures or instructions. One who possesses such an attitude is reluctant to follow instructions, orders or being told what to do: for example, anaesthetists who do not follow algorithms and guidelines on difficult airway management and CICO scenarios.
Impulsiveness ("Do it quickly")	Anaesthetists with an attitude that something has to be done immediately. The action is not well thought out and may not be appropriate. Although prompt action is recommended, anaesthetists need to assess the situation and act accordingly.
Invulnerability ("It won't happen to me")	Mindset that accidents and incidents occur to others but not oneself. Invulnerability tends to increase as experience increases, provided nothing serious has taken place. The anaesthetist's invulnerability attitude is likely to increase with successful outcomes following dangerous encounters. It is important for anaesthetists to realise that incidents occur regularly and they happen to staff with all levels of experience.
Macho ("I can do it")	Anaesthetists with a competitive attitude are willing to take extra and unnecessary risks to prove themselves or to others. Despite the name, this trait is applicable to both men and women.
Resignation ("What's the use?")	Resignation is a belief that outcomes are never dependent on one's own action. When outcomes are positive, anaesthetists will believe it is because of luck or chance. When outcomes are not favourable the anaesthetists will blame themselves or attribute it to bad luck. Because of this they will leave the control to others.

been assessed, particularly in the context of rare emergencies such as CICO scenarios. In anaesthesia, an increasing use of supraglottic devices leads to reduced experience in bag-mask ventilation and tracheal intubation[15,16]. The fact that a supraglottic airway device may be relatively effective for managing a difficult airway has probably contributed to the reduction in CICO scenarios[17]. Ironically, this itself may have contributed to a lack of familiarity with managing such emergencies when they do arise.

Many anaesthetists today will never need to perform an emergency surgical airway during their entire professional life[18]. As a consequence, in Australia and New Zealand, the skill required may be acquired only through a limited number of educational activities. These include: 1) Advanced Trauma Life Support, 2) Early Management of Surgical Trauma, 3) Emergency Management of Anaesthetic Crises, 4) "Airway Skills" workshops (http://www.airwayskills.com/page.php?1), 5) National Airway Training Course for Anaesthetic Trainees (http://www.anaesthesia.mh.org.au/about-natcat/w1/i1001250/) and 6) surgical airway workshops using anaesthetised sheep at the Royal Perth Hospital and Royal Brisbane and Women's Hospital. A number of locally based emergency surgical airway workshops are also available throughout Australia and New Zealand. Unfortunately, skills learnt from manikin-based workshops do not necessarily transfer to clinical practice[19,20].

HUMAN FACTORS

It has been suggested that psychological factors may be important[21]. Simply recognising the possibility of fixation on supraglottic airway manoeuvres is probably not enough to avoid its occurrence. Reason[22] refers to "the catch-22 of human supervisory control". Humans are poor at routine tasks such as monitoring pulses, blood pressures and respiratory rates, although this is what anaesthetists do most of the time. A well-designed machine with appropriate alarms can do this better than any person. The reason for keeping humans in the system is their ability to solve problems by being flexible, intuitive and resourceful. Unfortunately, monitoring very safe anaesthetics over many years does not keep these skills honed and ready for use when needed.

Humans are voracious pattern recognisers. Most of our decisions are rule-based. We match any given situation to pre-stored schemata and then respond using pre-learnt patterns of behaviour. Despite strong logical arguments supporting the teaching of algorithmic approaches to crisis management, the evidence suggests that the human mind simply doesn't work in this way. Klein[23] emphasises the importance of previous experience in the development of expertise for use in acute situations. Engineers and scientists depend on 'knowledge-based' approaches to problem solving[22]. This term may be misleading, as the key element is the requirement for slow, effortful thought. The term 'deliberation' may be more appropriate[24]. While very effective, this approach has one major drawback in an airway crisis – it is slow.

Klein[23] observed numerous diverse crises in situations ranging from fire fights in war zones to fighting house fires, and has shown clearly that successful experts don't usually work through prolonged and rational deliberations. They have 'been there' many times before and have learned what works in each situation. The greater their previous experience, the more likely they are to have the appropriate response.

It is therefore relevant to reflect on how often anaesthetists practise crisis management in general, and emergency surgical airways in particular. In respect of the latter skill, how often do they even pick up a scalpel and make a skin incision? For many, crisis management is practised infrequently and for most, making a substantial incision through the anterior neck tissue is never considered, let alone practised. Reluctance to start when in a highly stressful situation is, therefore, understandable.

IMPROVING CICO MANAGEMENT AND EMERGENCY AIRWAY SKILLS

Some suggestions on what can be done to improve CICO management and emergency airway skills are listed in Table 2. One key to successful emergency surgical airway crisis management is training. It must be recent, frequent and relevant. Current approaches to training of anaesthetists for CICO situations leave large gaps in all three of these elements. If the last time one performed an emergency surgical airway was 20 uneventful years of practice ago, it is likely one will struggle to remember what to do. Patterns may not be recognised and, even if they are, pre-formed responses might be hard to recall. To be competent at difficult airway management procedures, one must practise them frequently.

The relevant skills for performing an emergency surgical airway include the important first step of coming to a decision, making the incision, placing the tube, establishing haemostasis and suturing.

TABLE 2
A summary of what can be done to improve CICO management and emergency airway skills – key recommendations by the authors

Reporting CICO	Relevant cases should be collated from all coroner's reports (i.e. National Coroners Information System) nationally through the Australian and New Zealand College of Anaesthetists for analysis and recommendations.
	Centralised reporting of incidents and near-misses involving emergency airway cases should be established (e.g. by the Australian and New Zealand Tripartite Anaesthetic Data Committee).
Standarisation of resources	Standardised difficult airway equipment should be provided in all private and public hospital anaesthetic areas including remote sites.
Training anaesthetic trainees and consultants	Emphasis should be increased on "crew resource management" for emergency airway scenarios in all airway training courses.
	Periodic airway management workshops (including emergency surgical airway skills) should be mandatory, beginning early in anaesthetic training and continuing as a regular mandatory part of continuing professional development.
	Anaesthetists (particularly trainees) should be encouraged to assist with elective tracheostomies to improve surgical skills and familiarity with neck anatomy.
	The number of manikin and animal model surgical airway (in vivo, whole animal, and dissected specimen) workshops should be increased.
Organisational changes	Clear communication and co-operation between specialties should be encouraged (especially anaesthesia, ENT, intensive care and emergency medicine) to promote timely management of emergency surgical airways.

CICO='can't intubate, can't oxygenate', ENT=ear, nose, throat.

Although practising tracheostomies would be the ideal, participation in any surgical operation would probably be of some benefit.

Practise of surgical airways on animals (as part of an approved educational activity with appropriate animal ethics approval) may have some value, especially if such participation has been recent. It is not clear, however, whether having incised the neck of an anaesthetised animal is helpful when faced with the previously unspoiled neck of a patient during an airway crisis. Moreover, in the clinical situation there may be associated airway swelling or other airway abnormality that may not be present in an animal model. Therefore, the clinical relevance of such animal models needs to be investigated.

Nowadays many anaesthetists become very skilled at keeping out of trouble by becoming very competent in the use of sophisticated non-surgical approaches to management of difficult airways. However, on occasion these skills may fail, so it is still necessary to develop and maintain emergency surgical airway skills.

REPORTING CICO AND 'NEAR-MISSES'

Coroners' reports, such as those presented above, are likely to be the 'tip of the iceberg' of emergency airway crises. There is no readily searchable database for airway emergencies that have led to permanent hypoxic brain damage for 'near-misses' which have not led to a coroner's investigation. Should we therefore wait and collect additional data before making changes? We would say no, as it is clear from what little data we have that there are already too many catastrophic outcomes in the present circumstances. With the available data, we feel that it is essential to make urgent changes now before further avoidable deaths occur. Nevertheless, more data will probably refine our recommendations over time.

The National Coroners Information System (NCIS, www.ncis.org.au) is a searchable database which may provide important information on CICO-related deaths. The Airway Management Special Interest Group and the Quality and Safety Committee of the Australian and New Zealand College of Anaesthetists (ANZCA) plan to search and collate data from NCIS on a regular basis and report their findings to ANZCA.

The ANZCA Mortality Working Group was developed under the auspices of ANZCA. The data relating to CICO-related deaths from anaesthetic mortality committees would supplement the information from the NCIS. Unfortunately, not all regions have a continuously functioning anaesthetic mortality committee. The working group therefore promotes the establishment and maintenance of appropriately resourced anaesthetic mortality committees throughout Australia and New Zealand.

Data on 'near-misses' may be obtained from the Australian and New Zealand Tripartite Anaesthetic Data Committee incident reporting project. This committee representing three organisations, the

Australian Society of Anaesthetists, the New Zealand Society of Anaesthetists and ANZCA, has developed a web-based anaesthetic incident reporting system. The results may be fed back into the system as part of a quality improvement process. It is likely that NCIS and Australian and New Zealand Tripartite Anaesthetic Data Committee will provide the basis of a valuable teaching tool for all ANZCA fellows and trainees.

Standardisation of difficult airway management resources is important, including the standardisation of emergency surgical airway equipment in all areas where difficult airway management occurs. This is an ongoing project of ANZCA[25]. Similarly, the ANZCA Airway Special Interest group plans to improve and monitor the quality of teaching in difficult airway workshops within Australasia.

TEACHING TRAINEES AND CONSULTANTS

The next step is revision of the teaching curriculum for anaesthetists. The Royal College of Anaesthetists[26] has included human factors into its new curriculum (under "Curriculum for a certificate for completion of training in Anaesthesia"). Though this section is not specifically associated with emergency surgical airway management, the basic and intermediate training level sections highlight the importance of critical incident management, while the intensive care section specifically states that trainees should have knowledge of "indications and methods of securing an emergency surgical airway". One of the authors (KG) is part of the ANZCA Curriculum Redesign Project and is currently reviewing proposed changes to the curriculum that focus on both the technical and non-technical skills of emergency surgical airway management.

"Crew resource management" is an integrated part of aviation training. It focuses not only on technical skills but also on leadership, interpersonal communication and decision-making in initial training, and at intervals during participants' subsequent professional careers. Part of the training is on communication skills and particularly on the technique of graded assertiveness and on allowing team members to question authority, in a respectful way, if they think safety is compromised. In the CICO scenario, this approach would encourage people other than the anaesthetist to suggest that a surgical airway should be performed when the patient is hypoxic and the situation is deteriorating.

Currently, little human factor training is usually incorporated into airway management workshops, though the Effective Management of Anaesthetic Crises course of ANZCA includes human factors in the airway module[27]. It is our opinion that all workshops should include this training to allow regular reinforcement of the skills throughout the anaesthetic curriculum. After Fellowship, we believe continuing professional development should include periodic mandatory attendance at an airway workshop with an emergency surgical airway component.

We need also to explore ways to increase anaesthetists' familiarity with simple surgical procedures. Medical students are allowed to scrub and assist under supervision for routine surgical procedures. Perhaps anaesthetists need to do the same. They should take any available opportunity to scrub for elective tracheostomies. If one has assisted while a competent surgeon carries out the dissection and has overcome one's inherent initial reluctance to make an incision, then the chance of taking the first step when required should be enhanced.

ORGANISATIONAL CHANGES

It is important to recognise system failure when this is the root cause of any individual error. Management decisions, rigid protocols and organisational pathways that have been set in stone for some time frequently contribute to critical incidents. For example, where difficult airways are expected there may be a failure to ensure adequate supervision of inexperienced staff. Anaesthetic, ear nose and throat, emergency medicine and intensive care consultants should work together to facilitate effective management of acute airway crises, even if this requires closer collaboration over scopes of practice.

CONCLUSION

The incidence of CICO scenarios leading to patient mortality is low but these cases are typically disastrous and they should be avoidable. It is the opinion of the authors that there is a clear need to improve the competence of anaesthetists' management of airway crises that require an emergency surgical airway. Important initiatives include better data collection for audits, standardisation of resources, organisational changes and training in, and maintenance of the required technical and non-technical skills.

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